Department of Environment, Great Lakes, and Energy
Water Resources Division

Michigan Coastal Management Program

Section 309 Assessment and Enhancement Strategy, 2021-2025

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Michigan Coastal Management Program
Section 309 Assessment and Enhancement Strategy
2021-2025

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I. Background

Within the Department of Environment, Great Lakes, and Energy (EGLE), Water Resources Division (WRD), the Coastal Management Program Unit (CMPU) administers the Michigan Coastal Management Program (MCMP). The MCMP's mission is to protect, preserve, restore, enhance, and wisely develop the coastal natural resources and cultural heritage on the longest freshwater coastline in the nation. The MCMP is part of the national program established in 1978 as a state-federal partnership. The national program consists of 34 coastal states, islands, and territories in coordination with the National Oceanic and Atmospheric Administration (NOAA), Office for Coastal Management (OCM), Stewardship Division, Coastal Communities Program.

The MCMP is a networked program established on three foundations, as outlined in the Michigan Coastal Management Program and Final Environmental Impact Statement, July 1978: (1) Improve the administration of existing shoreland statutes; (2) Provide substantial technical and financial assistance to local partners for creative coastal projects; and (3) Improve the governmental coordination to reduce time delays, duplication, and conflicts in coastal management decision-making, otherwise known as federal consistency.

The WRD's Field Operations Support Section (FOSS) is responsible for the effective administration of the permitting and compliance activities within the designated MCMP coastal boundary. The MCMP coastal boundary, generally, is defined as 1,000 feet landward of the ordinary high-water mark. The coastal boundary also encompasses coastal inland lakes and other critical ecosystems. The FOSS provides technical assistance and regulatory oversight over activities such as dredging or filling of wetlands; and building in designated critical dune areas, environmental areas, coastal wetland, or coastal floodplain in the following programs: Part 31, Water Resources Protection; Part 301, Inland Lakes and Streams; Part 303, Wetlands Protection; Part 323, Shorelands Protection and Management; Part 325, Great Lakes Submerged Lands; and Part 353, Sand Dunes Protection and Management; of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA).

The CMPU is committed to providing substantial technical assistance and strategic grant funding to assist stakeholders' ability to understand risks and options to mitigate coastal hazards; create healthy habitats that provide for human use and enjoyment; support coastal eco-tourism while ensuring safe public access; and support resilient and sustainable coastal economies. As connectors and collaborators, the MCMP advances the research on the effects of a changing climate and resilient planning methods and seeks a balanced approach to a sustainable coastline with the main objective to connect people and communities to the Great Lakes coast. The federal consistency review duties are also administered within the FOSS and are closely coordinated with the CMPU.

Section 309, Coastal Zone Enhancement Grants, of the Coastal Zone Management (CZM) Act (Title 15 of the Code of Federal Regulations, Part 923, Coastal Zone Management Program Regulations, Subpart K, Coastal Zone Enhancement Grants Program) establishes a voluntary enhancement program for coastal states, territories, and islands with federally approved coastal management programs to continually improve its programs in specific areas of national

importance. Under the provisions of Section 309, NOAA, OCM encourages coastal programs to strengthen and improve their programs on five-year cycles by conducting self-assessments in the nine enhancement areas. The enhancement areas include wetlands; coastal hazards; public access; marine debris; cumulative and secondary impacts; special area management planning; ocean/Great Lakes resources; energy and government facility siting; and aquaculture. Guided by the assessments, the MCMP identifies high priority issues and gaps the program should address through strategies approved by NOAA, OCM. States with approved assessment and strategies are eligible for financial support provided under Section 309.

Stakeholder Engagement Survey

The CMPU launched its MCMP Section 309 assessment process by conducting a stakeholder engagement survey sent to over 300 local units of government, nonprofits, regional council of governments, and university partners. The survey responses were primarily received from local units of government (67%), followed by regional councils of government (17%), then by nonprofits and academia (both at 8%). The survey responses overwhelmingly provided the CMPU a clear "line in the sand" for the top enhancement areas to address which are listed in the following order of importance:

1. Increase the understanding of risk and mitigation associated with coastal hazards, (e.g., erosion, flooding, and coastal storms).
2. Enhance public access for the use and enjoyment on Michigan's coastline.
3. Protection, restoration, and preservation of coastal wetlands.
4. Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development.

The survey's intent was to solicit opinions about coastal management priorities and needs to help direct the MCMP's work. The survey asked the following questions:

1. Describe your current or past working experience you have had with the MCMP.
2. Based on the MCMP mission statement, identify the top three areas that the MCMP should mostly focus on.
3. Based on the top areas selected, what are the biggest challenges for each area?
4. What are the opportunities for the MCMP to more effectively address the challenges?
5. In what manner (e.g., technical assistance, trainings, outreach, research, or other) do you see the MCMP best addressing the issues?
6. What are the biggest challenges facing coastal communities' ability to be resilient?
7. Where do you see the MCMP role, or how could the program change or enhance itself, to better support efforts to build coastal resiliency, adapt to climate change, or address other coastal issues facing communities?

Responses to the question on experience with the MCMP was either as a past grant recipient or none; while the responses to challenges varied, lack of funding and public awareness was identified most often. With the question on what the MCMP can do to be more effective, a few common responses highlighted the MCMP to provide as much information as possible to help decision-making by delivering information and continuous education to local decision-makers,

and by supporting applied research to better understand key coastal ecosystems. How the MCMP would address the issues would be through training, outreach, and research.

The best summary response for the biggest challenges facing coastal communities' ability to be resilient was the lack of knowledge and professional staff to adequately identify vulnerabilities and how the community would react and respond. The final question asked how the MCMP could be enhanced to better support efforts to build coastal resiliency, adapt to climate change, or address other coastal issues facing communities. The recommendation was for the MCMP to provide public information meetings, ongoing funding support, training on best practices and/or training that addresses resiliency, and template planning documents for local communities.

The Engagement Survey report can be found in Appendix A.

Public Comment on Draft Assessment and Enhancement Strategy, 2021-2025.

The MCMP published the draft Assessment and Enhancement Strategy for a 30-day public comment period on November 6, 2020. A comment received from an emergency management administrator from a community that is situated outside of the MCMP coastal boundary expressed that even though their city does not have direct impact on the coastline there are still potential impacts to upland communities in the riverine/watershed systems. From an emergency management perspective, additional analysis of the cumulative and secondary impacts on how inland communities and the waterways are impacted by climate changes and variations (e.g., highs and lows) of the Great Lakes water levels is needed.

As the Great Lakes water levels rise and fall combined with impacts of more intense and frequent storm events, the effects are realized statewide; however, one must keep in mind that coastal communities face a harsher reality of the "perfect storm". That is, coastal communities face far greater culminative and secondary impacts resulting from hydrology (e.g. quantity of water in the system) from the upper watersheds as well as the impacts from coastal storms all of which are being intensified at the coastline with the effects of climate change.

II. Summary and Achievements to date on the MCMP 2016-2020 Coastal Geophysical Properties and Resiliency Strategy

The NOAA, OCM approved the MCMP 2016-2020 Coastal Geophysical Properties and Resiliency Strategy (Resiliency Strategy) on December 8, 2015, with the expectation of a MCMP program changes. In part, the MCMP program change will be accomplished by the creation of a technical guidance document targeting local decision-makers on the benefits of developing resilient master plans and policies. The other program change will be sought through a policy change proposed to WRD Management via an update to the WRD policy, Considering Climate Change in WRD Programs, by identifying the technical guidance document as an example of implementation of the policy.

The MCMP launched the Resiliency Strategy striving to learn what local decision-makers understood for reducing risks to coastal hazards (erosion, flooding, and coastal storms) and what to do to protect their coastline. Partnering with a project team of researchers and community planning leaders, the MCMP is developing a program for applied research in scenario-based planning methods, via pilot communities, and creating site-based data tools. Research conducted to date in approximately eight pilot coastal communities suggests that coastal communities are not directly planning for their coastal areas. Traditional scenario-based planning methods are not incorporating coastal resource areas for protection nor mitigation. Further, significant gaps exist with hazard-based (risk due to erosion and flooding) data for the entire coast as well as community, site-specific areas.

Simplified decision-making approaches incorporating hazard-risk scenarios are developed to help visualize what the "*Expected – Lucky – Perfect Storm"* may look like in community planning through a range of physical conditions. These scenarios, along with model plan and ordinance language, are being developed to increase the knowledge for local decision-makers. Resulting hazard-ready Resilient Master Plans better align with the community's vision for their coast and help institutionalize management measures to adapt, accommodate, and 'step back' development from sensitive and dynamic coastal features.

For challenging questions such as, "How fast is the bluff eroding?" "What section of the coast is most prone to flooding?" and "What might the beach look like in 30 years?," the MCMP is supporting the developent of a tool to look at those questions in an online "80-year" viewer showing photographic evidence of beach and shoreline change. At a minimum, the coastal change viewer provides local officials and property owners a first-hand view on the dynamic nature of the coast over the long-term. The project team is furthering these efforts to provide a coastal vulnerability index (CVI) within the viewer and to develop future-scenarios for coastal erosion based on the information being developed and provided through the coastal change viewer. This would allow communities to develop hazard-risk scenarios for coastal erosion in addition to those that are currently being developed for coastal flooding.

The goal for the Resiliency Strategy is to develop policy and technical guidance targeting local decision-makers that promotes hazard-ready coastal communities; communities that can absorb and adapt to changes in Great Lakes water levels, coastal storms, and floods. Hazard-ready communities provide space for beach and dunes to migrate naturally, so they can

continue to serve the community, which includes functioning to absorb erosion and flooding impacts.

Achievement to date:

- The MCMP partnered with Land Information Access Association (LIAA), Michigan Technological University (MTU), and University of Michigan (UM) to directly engage with eight pilot communities to date. The type of local program change is dependent upon the local needs and views of each community and ranges from development of chapters for prospective inclusion in future local master plans to updated master plans or ordinances that incorporate coastal resilience principles. The pilot communities include the following:

    1. City of Bridgman (Resilient Master Plan)
    2. Bear Creek Township (Resilience Chapter)
    3. Port Austin Township (Resilient Master Plan)
    4. Port Austin Village (Resilient Master Plan)
    5. Leland Township (Resilience Chapter)
    6. Alpena County (Resilience Chapter)
    7. Emmet County (Resilience Chapter)
    8. St. Clair County (Resilience Chapter)

- The city of Bridgman serves as an example of local program enhancement through improvements made within the community's updated master plan. Bridgman's updated master plan includes an entire chapter on Planning for Coastal and Climate Trends, along with an additional chapter on Defining Vulnerability in the Bridgman Community. "Understand Coastal Processes", "Understand Dune Dynamics," and "Build Community Resilience" were among the ten community-identified guiding principles for the master plan. The plan lays the groundwork for future implementation advancements in the community through the Goals and Actions Strategies chapter of the master plan which includes the following:

    - "Consider changing the setback on the Residential Lake District for Lake Michigan fronting properties to more than 25 feet."
    - "Consider establishing an overlay district that would not allow for the placement of a seawall or any other hardening along Lake Michigan."

- Efforts in the remaining communities continue as the communities' work towards incorporating coastal hazards information into their planning and zoning actions in a manner consistent with their local planning timelines and visions.

- A Coastal Change Viewer developed by MTU has been made publicly available at: (http://geospatialresearch.mtu.edu/czmp). The viewer is a critical tool towards providing insight on the dynamic nature of Michigan's Great Lakes coast through time. The viewer shows Great Lakes shoreline and bluff line (where applicable) movement through time with data going back to 1938. Aerial imagery through time is included along with the

digitized shorelines and bluff lines. The viewer is complete for Michigan's lower peninsula Lake Michigan and Lake Huron shorelines.

- LIAA is facilitating programs referred to as Navigator Training that provide a broad overview of coastal dynamics, resilience planning, and how changes in climate and Great Lakes water levels are impacting communities. In addition, the training programs provide an overview of scenario-based planning tools and how planners and local officials can use coastal hazards data to inform local planning.

- A series of white papers have been developed by the UM to inform coastal resilience planning:

    - "Overlooking the Coast: Limited Local Planning for Coastal Area Management along Michigan's Great Lakes." This paper provides an evaluation of local efforts to manage Great Lakes coastal shorelands through master plans, focusing on Michigan localities. Findings showed that Michigan communities were largely failing to consider coastal areas and dynamics in their planning. The paper also finds that having knowledge about coastal dynamics appears important in explaining local planning efforts, but having the capacity to act on that knowledge and the commitment to do so are equally or more important.
    - "Using Simple Decision-Centered Scenario-Based Planning to Integrate Coastal Hazard Management into the Master Plans of Small Great Lakes Communities." Presents methods for applying scenario-based planning to coastal hazards mitigation. The paper also provides findings and observations from participatory action research (PAR) of selected Great Lakes coastal communities where these scenario-based planning approaches were applied.
    - "Local Zoning in Michigan for Great Lakes Coastal Shoreland Management Initial Findings and Guidance." This paper presents a preliminary review of zoning ordinance provisions that coastal communities might adopt to improve their management of coastal hazards. This review primarily occurred in the northwest region of the Lower Peninsula.

- The MCMP's 2019 Project of Special Merit is working in collaboration with the Michigan Association of Planning (MAP) to develop technical training to implement the MCMP technical guidance document with a flipped classroom format. The MCMP has worked with the Michigan Sea Grant (MSG) to develop a six-video series outlining the path to community resilience. The videos will be housed on the EGLE MCMP Resilient Coast webpage as well on the partners websites in an effort of strategic messaging.

III. Phase I. Assessment Findings

The MCMP completed a high-level analysis of the nine enhancement areas following the NOAA Section 309 guidance. The following section outlines the assessment findings.

A. Wetlands

Section 309 Enhancement Objective: Protection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands. §309(a)(1).

Note: For the purposes of the Wetlands Assessment, wetlands are "those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." [33 CFR 328.3(b)].

Resource Characterization:

Great Lakes coastal wetlands offer recreational and tourism opportunities in addition to a variety of beneficial ecological services. Coastal wetlands are well known for serving vital functions such as providing wildlife habitat and improving water quality, but coastal wetlands are equally valuable as natural barriers to slow waves and storm surges through friction and providing flood storage and control functions.

Based on the processing of 2016 NOAA's C-CAP Coastal Land Atlas raw data utilizing a wetland modeling tool developed by MCMP staff to analyze the data, it was calculated that Michigan currently has 5,304,199 acres of coastal wetlands within the MCMP coastal counties, and 351,603 acres within its coastal boundary. The following table indicates the latest status and trends for Michigan's coastal wetlands from 1996 to 2016 and from 2010 to 2016.

Coastal Wetlands Status and Trends (Coastal Counties)		
Current state of wetlands in 2016 (acres)	5,304,199	
Percent net change in total wetlands (% gained or lost)	from 1996-2016 - 0.52%	from 2010-2016 - 0.03%
Percent net change in freshwater (palustrine wetlands) (% gained or lost)	from 1996-2010 - 0.52%	from 2010-2016 - 0.03%
Percent net change in saltwater (estuarine) wetlands (% gained or lost)	from 1996-2016 - N/A	from 2010-2016 - N/A

Table 1: Coastal Wetlands Status and Trends (Coastal Counties)

The following tables report the coastal wetlands status and trends within the MCMP coastal boundary.

Coastal Wetlands Status and Trends (Coastal Boundary Management Program)		
Current state of wetlands in 2016 (acres)	351,603	
Percent net change in total wetlands (% gained or lost)	from 1996-2016 - 4.20%	from 2010-2016 - -0.22%
Percent net change in freshwater (palustrine wetlands) (% gained or lost)	from 1996-2016 - 4.20%	from 2010-2016 - -0.22%
Percent net change in saltwater (estuarine) wetlands (% gained or lost)	from 1996-2016 - N/A	from 2010-2016 - N/A

Table 2: Coastal Wetlands Status and Trends MCMP

As previously reported in the last 2016-2020 Assessment, the state has a more detailed wetland inventory then what is provided in NOAA's C-CAP Coastal Land Atlas. The State's wetland inventories were produced on a county-by-county basis, all in the same manner and integrated into the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) datasets. The wetland datasets can be viewed as maps in NWI Wetlands Mapper and EGLE's online Wetland Map Viewer. The state is currently updating the inventory, but the latest inventory to be completed and integrated in into the NWI Wetlands Mapper and EGLE's online Wetland Map viewer occurred in 2005. Because of this reason, the latest dataset for C-CAP data (2016) was used to estimate coastal wetland acreage in the state.

The following table provides the changes in the number of wetlands in square miles converted to developed land, agriculture, barren land, and open water from 1996-2016 when the data was first collected, and 2011-2016 and since the 2015 assessment.

Land Cover Type	Area of Wetlands Transformed to Another Type of Land Cover Between 1996-2016 (Sq. Miles)	Area of Wetlands Transformed to Another Type of Land Cover Between 2011-2016 (Sq. Miles)
Development	6.43	0.50
Agriculture	6.18	1.66
Barren Land	4.54	0.64
Water	13.54	9.01

Table 3: How Wetlands Are Changing

In 2016 , the MCMP partnered with the UM, MTU, Michigan Technological Research Institute (MTRI), and LIAA, to develop the methodology to map coastal wetland zones of dynamic coastal influences (ZDCI). The ZDCI refined the distinction between lands inundated and wetlands that are hydrologically connected through inundation. The UM, MTU, and MTRI incorporated the calculations, mapping, and information from the Great Lakes Aquatic Habitat Framework (GLAHF) into the ZDCI for all of the 41 Lower Peninsula coastal counties. The information from each county was based on vegetation maps, Digital Elevation Models (DEMs), and county elevation data developed by MTU and MTRI. UM also incorporated the modeled connectivity data developed by MTRI and the high, low, surge, and wave-run-up water levels developed by MTU. Using all of this information, UM developed a page on the

GLAHF Web site (https://www.glahf.org/coastal-wetlands/) for all data on coastal wetlands and an interactive Coastal Wetlands Explorer for viewing the delineated coastal wetland boundaries. The boundaries can be viewed by type or the alternative ZDCIs, which enables users to zoom in on a given location and manipulate the data layers to be included for various types of mapping and/or downloading formats. UM also developed printable county maps that include the two different versions of ZDCIs (i.e., geomorphic and elevation) with modeled connectivity capabilities.

This work resulted in the creation of spatial predictions of coastal wetlands in the Lower Peninsula of Michigan; but creation of spatial predictions for coastal wetlands and the ZDCI is needed for the Upper Peninsula for communities that border Lake Superior and the upper sections of Lake Michigan and Huron. Since the completion of the project in 2018, the MCMP is not aware of plans to conduct additional work to complete maps for the upper peninsula.

An important outcome of this work is the methodology used to develop rapid wetland connectivity maps that can be easily applied to other coastlines using hydrological modeling and DEMs, rather than through time-intensive image interpretation. By identifying where wetlands in Michigan's Lower Peninsula are hydrologically connected to Great Lakes waters and consequently assess what land areas are periodically inundated by Great Lakes water, the analyses reveal that connected wetlands are concentrated on the eastern side of Michigan's Lower Peninsula. During average water levels, 96% of the connected wetlands in Michigan's Lower Peninsula are predicted to be along the shores of Lakes Huron, St. Clair, and Erie. The data could help local decision-makers understand where coastal wetlands are located and whether they are connected directly to the Great Lakes waters at varying levels. This information could be utilized by the MCMP as part of efforts to assist communities with developing vibrant, healthy, and resilient coastal communities through preservation, protection, restoring, and enhancing healthy coastal ecosystems.

The ZDCI was designed to inform local decision-makers of the land areas influenced by Great Lakes waters. The data layers are intended to identify the distinctions between lands inundated generally and wetlands hydrologically connected to the Great Lakes through inundation. The data layers help local governments and decision-makers improve shoreland management and enhance resiliency by adopting policies that restrict development in areas influenced by Great Lakes waters and provide wetland inventories that can be utilized in recreational or other community plans. Since the project completion, the MCMP is unaware if any related outreach has occurred, but the final report and maps are posted on the GLAHF Web site as identified above.

Management Characterization:

Revisions to the state statute Part 303 of the NREPA, occurred 2019. Senate Bill 1211 (now PA 631 of 2018) went into effect on March 28, 2019. These changes amended the following sections of the NREPA: Part 13, Permits (details requirements and processes for permit application, review, approval or denial, and petitioning a permit decision; applies to all divisions who engage in NREPA permitting; Part 15, Enforcement (details enforcement authorities and procedures required under the NREPA, including those related to civil enforcement action),

Part 301, Inland Lakes and Streams (regulates inland lakes and stream activities as defined under statute), and Part 303, Wetlands Protection (regulates wetland activities as defined under statute). Overall, the amendments did not result in major changes, but add requirements on the WRD to document decisions and consider federally defined Waters of the United States (WOTUS) when determining jurisdiction.

Minor modifications were also made to other enforcement and permitting processes. It is unlikely that the new amendments made by PA 631 of 2018 deregulate wetlands, lakes, or streams. WRD has the Wetland Identification Program and pre-application services available to assist the public in identifying whether there are regulated wetlands on their property.

Though the changes are not significant, they require minor modifications to Part 303. Below is a summary created by WRD for the public on the changes in PA 631 that impact Part 303, which should be used in conjunction with the language provided in the new amendments as follows:

- Part 13 and Part 15 Changes: Requirements were added for the specific documentation needed by EGLE for permit approvals with modification, denials, and civil enforcement actions under Part 301 and Part 303.
- Part 301 and Part 303 Definitions.
    - The main definition of inland lakes and streams remains the same.
    - The main definition of wetland has been reworded, but the meaning remains the same. However, the amendments add artificial or natural lakes, ponds, or impoundments and wetlands that are a WOTUS under the federal Clean Water Act.

The language allowing non-contiguous wetlands less than five acres in size to be regulated if determined to be essential to the preservation of the natural resources of the state has been removed. However, language was added regulating wetlands with the documented presence of state or federal endangered or threatened species and wetlands that are rare and imperiled.

    - Other Definitions Changes:
        - The definition of hydric soil from the federal delineation manual and regional supplements which are already in use in Michigan was added.
        - The list of rare and imperiled wetlands was modified.
        - Farm or stock ponds constructed consistent with the exemption under 30305(2)(g) are now not considered ponds for the purposes of the definition of “contiguous.”
        - Voluntary wetland restoration definitions were added to make the bill consistent with the recently passed bills on voluntary wetland restoration. These new definitions do not apply to other sections of the statute (i.e., the definitions should not be used outside of voluntary wetland restoration project reviews).

- Other Amendments:
  - Language was added clarifying that borrow material for farm and forest road construction and maintenance be taken from upland sources if feasible.
  - The amendments remove mention of restoration orders and allow WRD to determine whether they accept an after-the-fact permit application on a case-by-case basis.
  - The requirement to create a bi-weekly list of applications has been removed, and language that already occurs in Part 301 referring to Web site postings has been added.
  - Additional language regarding entering the premises for inspections has been added.
  - The amendments provide that reasonable expert professional witness fees, as determined by the court or an administrative law judge, must be awarded to a landowner that prevails against the WRD on whether the landowner's property is a wetland.

The WRD participated in the Coastal Conservation Work Group which was developed under the Upper Midwest and Great Lakes Landscape Conservation Cooperative (LCC) which focused its efforts on the Saginaw Bay to Western Lake Erie region. The LCC has since lost funding. However, the partners within the Coastal Conservation Work Group wanted to keep the workgroup together and formed the Great Lakes Coastal Assembly (Coastal Assembly). The WRD is a partner in the newly formed Coastal Assembly which has expanded its membership to include representatives from other Great Lakes states and Canadian government. The assembly has several purposes: to promote collaborations aimed at management, restoration, and conservation of coastal areas; to assist organizations in assessing where investments should be made, and how to align them with regional, state, and local goals; to identify needs for science and decision support data and tools; and to enable actions that help coastal managers make effective decisions.

The main goal of the WRD's Wetland Assessment and Monitoring Program is to assess the State's effectiveness in protecting, managing, and restoring Michigan's wetlands that have public benefits as defined under Part 303 of the NREPA. WRD developed the State of Michigan Wetland Monitoring and Assessment Strategy (Wetland Strategy) which includes landscape level, rapid and intensive wetlands assessment methods, and statewide monitoring goals, and was finalized in March of 2015.

To meet the goals of the Wetlands Strategy, the Wetland Assessment and Monitoring Program is tasked with implementing the monitoring objectives outlined in the strategy. These include updating the inventory of Michigan's wetland resources by gathering and analyzing geographic information system remote sensed data, updating the National Wetland Inventory maps, applying Landscape Level assessment on a watershed scale, and using the Rapid assessment Method to assess wetland functions and values, regardless of ecological type.

Since 2015, the WRD received funding from various sources including U.S. Environmental Protection Agency (USEPA), Renew Michigan Fund (state funds designated for critical

upgrades to road and water infrastructure and environmental improvements), Southeast Michigan Council of Governments, and USFWS to conduct inventory of Michigan's wetland resources. Kent and Washtenaw counties were completed using funds from USEPA; 12 southwest/central counties (including three coastal counties, Allegan, Van Buren, and Berrien) are in progress and being funded by Renew Michigan Fund; six southeast counties (including four coastal counties, St. Clair, Macomb, Wayne, and Monroe) are in progress and being funded by Southeast Michigan Council of Governments; and in the Upper Peninsula, wetland inventories funded by USFWS are in progress for two watersheds. One watershed is located in Marquette, Alger, and Delta counties, and the other is located in Schoolcraft, Luce, and Mackinac counties. In 2020, wetland inventory of 29 counties centrally located in Michigan between Lake Michigan and Lake Huron (including eight coastal counties, Mason, Oceana, Muskegon, Ottawa, Bay, Tuscola, Huron, and Sanilac) will commence. Renew Michigan funding will be used to complete the inventory for these counties.

Since the Wetland Strategy was finalized, WRD has conducted Level 3 Intensive Site Assessment used in part to refine and verify the rapid wetland assessment method to diagnose the cause of wetland degradation (Level 3 Assessment). In 2016, the WRD partnered with the USEPA to conduct Level 3 Assessments on 19 sites, part of the USEPA's National Wetland Condition Assessment efforts to assess wetland functions and values. The sites were randomly selected using USFWS Status and Trends Plots. Since 2016, the WRD received additional funding and randomly selected 83 sites where permission was obtained from the landowner to conduct the site assessments. This resulted in assessments being conducted on state lands. Of the 83 sites randomly selected, less than five were located within the coastal boundary. A total of 100 sites were assessed. It is anticipated that the assessment data from these 100 sites will be incorporated into the online Wetland Map Viewer in 2020.

The WRD participates in the Great Lakes coastal wetland monitoring project funded by the Great Lakes Restoration Initiative led by Central Michigan University (CMU) in partnership with various U.S. and Canadian universities and federal agencies, private and nonprofit organizations. WRD's role included facilitating the communication between researchers and agencies participating in the project. The Great Lakes Coastal Wetland Monitoring Program was initially a five-year monitoring project based on a study developed by the Great Lakes Coastal Wetlands Consortium in 2008. The monitoring project timeframe was initially from 2010 to 2015, but in 2015 another $10 million in funding was received to continue for the next six to 10 years.

The goal of this project is to monitor the conditions and trends of every coastal wetlands within the Great Lakes basin. Approximately 1,039 acres of coastal wetlands that are greater than four hectares in size and have a surface water connection to the Great Lakes are being monitored after five years. Data gathered at each site included information on birds, amphibians, fish, invertebrates, plants, water quality and habitat. The Great Lakes Coastal Wetland Monitoring Program continues to lead the basin-wide monitoring efforts of Great Lakes coastal wetlands and continues to work on updating the coastal wetlands polygons (e.g., geographic representation of a wetland area) that are currently being used in the Site Mapping and Great Lakes Coastal Wetlands Decision Support Tools hosted by CMU (Decision

Support Tool). The Decision Support Tool was initially developed for Saginaw Bay, Lake St. Clair, and Western Lake Erie, but through funding provided by the MCMP, the geographic area for the tool was expanded to cover all of Michigan's coastline. The link to the wetland monitoring reports/publications, Site Mapping and Decision Tools, can be found on the CMU Web site located at (https://greatlakeswetlands.org/Home.vbhtml).

This platform and information is available to researchers, state wetland managers, and local decision-makers to help guide restoration and conservation efforts in Michigan. This is a tool that the MCMP can utilize to meet its strategic goal of ensuring Michigan's coastal habitats are protected, preserved, and restored for use and enjoyment of Michigan's citizen's and visitors by providing technical assistance to coastal communities.

Management Category	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	N
Wetlands programs (e.g., regulatory, migration, restoration, acquisition)	N

Table 4: Significant Changes in Wetland Management

The program change achieved as a result of the Section 309 Assessment and Five-Year Strategy for CZM Program Enhancement Fiscal Years 2012-2016, Strategy: Climate Change Adaptation in Coastal Wetland Management, the WRD adopted an internal climate change adaptation policy WRD-046, Considering Climate Change in Water Resources Division Program on February 12, 2016. The WRD-046 policy states that "The WRD should consider the impacts of climate change and aim to implement adaptation and mitigation measures within its programs in an effort to minimize the degradation and impairment of the state's water resources due to climate change."

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

   High ☒
   Medium ☐
   Low ☐

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The majority of the respondents indicated that the protection, restoration, and preservation of coastal wetlands was identified as one of the top three areas that the MCMP should focus its effort on. Survey participants indicated that the biggest challenges specifically to wetlands included in part: identification, delineation of boundaries and regulating wetlands; implementation of public policy that supports wetland protection and not impacts; MCMP

funding is generally too small to leverage large-scale projects, and can't be used as match with other federal funding sources; public awareness of the issues; convincing people to value natural resources and to think of them as finite; and number of threats, including better understanding of impacts of the changing water levels, and how different types of development impact different types of coastal ecosystems.

When participants were asked what the opportunities for MCMP were to more effectively address the changes, the overall response was to provide more information and public outreach. Specifically, participants indicated development of key messages to the public on the importance of coastal wetlands, including functions, values, and priority conservation opportunities.

As described in the Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005 developed by WRD and finalized July 2014, Great Lakes coastal wetlands are among the most biologically diverse ecosystems in Michigan. It was reported that "Michigan's wetlands continue to face increasing threats, including historic threats such as agriculture and development, as well as new threats like invasive species and climate changes." Additionally, coastal wetlands are also impacted by the variability of the Great Lakes water levels. These threats continue to be stressors on the health of coastal wetlands.

WRD continues to conduct wetland monitoring and assessment work state-wide as funding becomes available. The monitoring of coastal wetlands that are greater than four hectares in size and have a surface connection to the Great Lakes by CMU and its partners has significant funding by the Great Lakes Restoration Initiative. However, there continues to be a data gap on monitoring on coastal wetlands that is less than four hectares. Future funding mechanisms need to be identified or state programs developed to increase the number of the coastal wetlands monitored by the State to have a better understanding of the health and function of all coastal wetlands as management efforts are focused on addressing the above-mentioned stressor. This is especially important as Great Lakes water levels are predicted to remain higher for the foreseeable future.
Development of adaptive management measures is needed to assist coastal communities with resiliency efforts to preserve and protect these important ecosystems. Coastal wetlands are dynamic systems that are subject to high-water levels and the associated erosive forces along with low water levels. Communities need to consider these changing water levels as part of their planning process.

As indicated above, another gap needed to be addressed is the completion of the creation of spatial predictions for coastal wetlands and the ZDCI for the Upper Peninsula, specifically for communities that border Lake Superior and the upper sections of Lake Michigan and Huron. Completion of these datasets are needed to ensure all coastal communities have this data when considering it short-term and long-term planning goals and strategies.

Given the status and trends for coastal wetlands within the coastal boundary, program gaps, and stakeholder engagement perspectives as described under Section III. Stakeholder Engagement (a complete list of the stakeholders and survey response are in Appendix 1), the MCMP rates Coastal Wetlands as a High Priority Enhancement Area. Invasive species,

development pressure and conversion to agriculture, and great lakes water levels continue to have an impact on coastal wetlands. Coastal wetlands serve a vital function as habitat for plant and wildlife species and provide a wide variety of ecosystem service for communities including maintaining water quality, providing recreational opportunities, flood storage, and erosion control. In order to achieve on-the-ground changes that protect, restore, and enhance coastal wetlands, coastal communities need to be empowered to take the necessary steps by strengthening their commitment and capacity to address the challenges that impact wetlands. To do this, coastal communities need to have the resources and tools to guide them towards long-term resilience planning, including the implementation of restoration and enhancement resilient options.

B. Coastal Hazards

Section 309 Enhancement Objective: Prevent or significantly reduce threats to life and property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level change. §309(a)(2).

Note: For purposes of the Hazards Assessment, coastal hazards include the following traditional hazards and those identified in the Coastal Zone Management Act (CZMA): flooding; coastal storms including associated storm surge; geological hazards (e.g., tsunamis, earthquakes); shoreline erosion including bluff and dune erosion; Great Lake level change; and land subsidence.

Resource Characterization:

The Great Lakes are experiencing the highest water levels since 1986, and storms and wave action are causing significant erosion and flooding along Michigan's coast. Great Lakes water levels are cyclical with periods of low and high-water, with each period lasting for several years depending on the relative amount of precipitation, runoff, and evaporation.

At the time of the previous Section 309 assessment efforts, water levels were just beginning to rise after an approximate 15-year low stand (see Figure 1). During the low water period, entrance harbor shoaling occurred impacting shipping and recreational boating; marina docks were so high above the water surface that they were unusable in some cases; and beaches expanded. In many cases the expanding beaches prompted new pressures for development situated further lakeward.

The rise in Great Lakes water levels that began in 2013 was the fastest on record. In 2019, all the Great Lakes were at least a foot higher than their long-term average water levels. Water level projections for 2020 anticipate the lakes will be similar to those elevations in 2019. Lakes Michigan and Huron are expected to exceed their annual levels to a greater degree than the other lakes, which is problematic due to the high level of development along the Michigan and Huron coasts.

During high-water periods Michigan's coast experiences, a variety of challenges, which in large part relate to the local shoreline type. Michigan's diverse coastal geomorphology is displayed through a wide array of shore types including dunes, bluffs, marshes, cobble, and hardground shorelines. High-water may cause irreversible erosion of coastal bluffs threatening any bluff top development by undermining, whereas in low-lying areas flooding will occur. One constant that spans most shoreline types during high-water periods is the reaction of attempting to stop the shoreline from moving through construction of engineered structures.

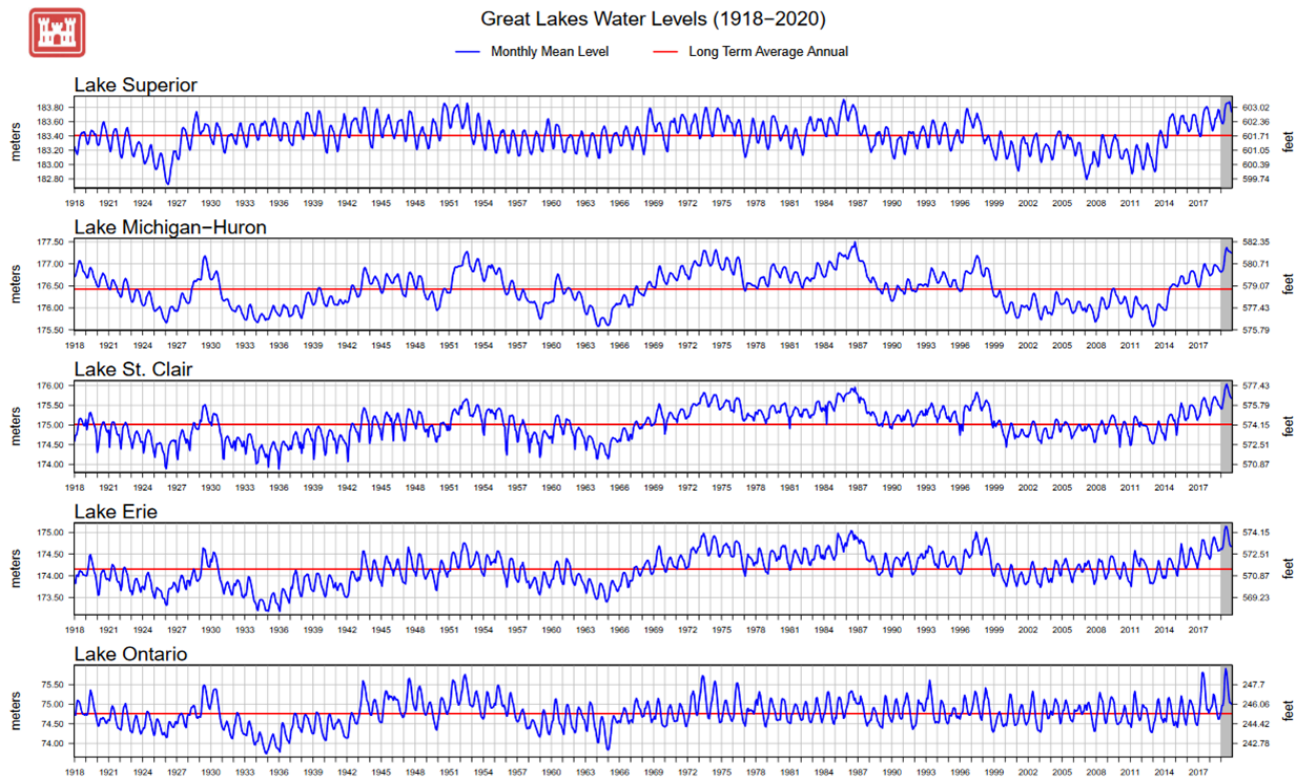


Figure 1. Great Lakes Water Levels: Year-to-Date, US Army Corps of Engineers

The table below indicates the general level of risk in the MCMP coastal boundary for various types of coastal hazards.

Type of Hazard	General Level of Risk (H, M, L)
Flooding (riverine, stormwater)	H
Coastal storms (including storm surge)	H
Geological hazards (e.g., tsunamis, earthquakes)	L
Shoreline erosion	H
Sea level rise	N/A
Great Lakes level change	H
Land subsidence	L
Saltwater intrusion	N/A
Other – Dangerous currents including rip currents	M

Table 5: Hazard Risk in the MCMP coastal boundary

Major stretches of Michigan's coast are subject to flooding and erosion hazards. Great Lakes level changes are explicitly identified as a hazard in the table above; however, impacts of such changes are typically expressed as erosion and/or flood impacts during high-water events or as shipping and recreation impacts during low water events. Michigan is not in an active tectonic area and therefore tsunamis and earthquake impacts are not anticipated. Land subsidence has not historically had a significant impact on coastal hazards along Michigan's Great Lakes shoreline. Due to isostatic rebound following the last period of glaciation in the region, the land under the upper Great Lakes is rising relative to the lower lakes. This isostatic rebound will result in relative changes in lake levels; however, the rate of change is occurring so slowly that it does not constitute as a hazard.

High-water levels have resulted in recent, significant impacts along the coast during storm events, including coastal erosion undermining homes, parking lots and other development, and flood impacts to homes and other infrastructure along low-lying coastal areas. Examples of the type of impacts experienced recently include:

- Roadways closed:
  - The city of Muskegon - located along the central Lake Michigan shoreline - closed Beach Street on Wednesday, September 25, 2019, because high-water and waves were crashing up and over the roadway causing dangerous conditions. The street, which is the primary road access to the city's popular Pere Marquette Beach, is expected to remain closed through the fall and winter.

  - Lakeshore Boulevard – located along the Lake Superior shoreline in the city of Marquette – was closed twice in the span of three weeks during September 2019 due to high waves crashing onto the roadway. Flooding and erosion are chronic issues along this stretch. The city has been awarded a grant from the National Fish and Wildlife Foundation that will support a managed-retreat effort to move the roadway landward, out of harm's way.

- Homes flooded:
    - The city of Luna Pier evacuated portions of the Allen's Cove neighborhood along the Lake Erie shoreline in April 2019 due to coastal flooding.

    - The city of Detroit installed sandbags in the Jefferson Chalmers neighborhood along the Lake St. Clair shoreline in July 2019 to reduce impacts from coastal flooding along the Lake St. Clair Shoreline.

- Homes/structures impacted by coastal erosion:
    - Great Lakes shorelands staff, WRD has begun maintaining an inventory of homes and other structures imminently threatened by erosion. Twenty-one entries are documented between 7/6/2014, and 10/22/2019. Three structures are listed as demolished; six structures as relocated; and eleven as at-risk.

- Coastal tourism impacted:
    - Flooding at Fishtown – This rare commercial fishing and popular tourist location, located in Leland, along the northeastern Lake Michigan shoreline is suffering from flooding impacts. Some of the historic waterfront shanties and businesses have been flooded and local fundraising efforts are underway to elevate some of the structures.

    - Beach eliminated and historic structure threatened at Orchard Beach State Park – Water is lapping at the toe of the bluff and no recreational beach remains at this State Park, located along the North-Central Lake Michigan shoreline. An historic, 1940's stone pavilion that sits about 50-feet from the top of the eroding bluff is threatened. The Michigan Department of Natural Resources (MDNR) is working with a consulting firm to identify options to save the structure and park lands.

Michigan's recreational, public trust beaches have receded significantly in both width and extent due to high-water levels, erosion, and increased use and effects from shore protection structures. Reduced beach widths have an undetermined economic impact on property values and coastal community tourism economies as well as providing decreased eco-system service values due to a decreased ability to protect the upland from coastal storms.

Eroding beaches have resulted in a significant rise in installations of shore protection structures, primarily in the form of shore-parallel revetments and seawalls. More than 500 permits for installation of shore protection were issued by EGLE, WRD in the first quarter of 2020. This is higher than the number of permits that would typically be issued during an entire year.

Traditional harden shore protection structures temporarily halt erosion of coastal bluffs and dunes; however, these structures also disrupt the supply of sand to beaches. The majority of Michigan's Great Lakes beach sand is derived from erosion of coastal bluff and dune systems and therefore the halting of erosion of these bluff and dune systems exacerbates the problem of a limited sand supply along our beaches. Beaches simply cannot be sustained when their sand supply is cut off.

Multiple efforts to better understand coastal hazards resource impacts, threats, and vulnerabilities have been undertaken or are on-going. Following is a summary of these efforts:

- Great Lakes Coastal Flood Study: The Federal Emergency Management Agency (FEMA) in partnership with the U.S. Army Corps of Engineers (USACE) is conducting a coastal analysis and mapping study to update Digital Flood Insurance Rate Maps (DFIRMs) for coastal counties along the Great Lakes. The mapping and analysis effort, which began in 2012, has resulted in new preliminary coastal flood maps for most Michigan coastal counties. Implementation of the hazard areas depicted within the updated maps will be rolled out on a county-by-county basis beginning in early 2020. The new flood risk information will be used to increase understanding of local coastal flood risk, facilitate mitigation efforts, and improve community resilience to Great Lakes flood events. For the first time along Michigan's coast, the updated Flood Insurance Rate Maps (FIRMs) will identify Coastal High Hazard Areas, or VE zones. VE zones differ from other Special Flood Hazard Areas in that they are exposed to powerful waves during large flood events. These areas are therefore prone to increased risk of structural damage to buildings and other infrastructure.

- Great Lakes Coastal Reporting Tool (https://superiorwatersheds.org/report-erosion-hazard): The Great Lakes Coastal Reporting Tool provides an easy-to-use, web-based portal for the public to provide, and view, information on coastal erosion, flood events, and other shoreline impacts. The brief eye-witness reports and site photographs provide valuable insight into coastal storm impacts and shoreline change over time. Superior Watershed Partnership and Land Trust Developed the Tool for use within their coverage area and therefore tool coverage is currently limited to Michigan's Upper Peninsula coast.

- National Shoreline Management Study – Lake Michigan: The Institute for Water Resources, USACE, in 2017, published the Lake Michigan report under the Congressionally-authorized National Shoreline Management Study. Management challenges for Lake Michigan that may be applied by policy makers, coastal engineers and scientists, and other stakeholders to improve coastal resilience are reviewed. A compilation of existing information summarizing characteristics such as: shoreline type and processes; sediment management; impacts of water level variations, effects of erosion, and shoreline governance is provided. Michigan's Lake Michigan shoreline is characterized in the report based largely on information from the WRD's high-risk erosion area (HREA) studies, a USACE Regional Sediment Management study in the early 2000's, and the USACE's Section 111 studies of the effects of navigation structures on adjacent shorelines.

- Great Lakes Shoreviewer (http://www.greatlakesshoreviewer.org/): The Great Lakes Shoreviewer (Shoreviewer) is a publicly accessible online mapping tool that includes color, aerial photographs (vertical and oblique), slope and elevation information, as well as preliminary mapping efforts to display vulnerability to erosion areas and steep slopes. Shoreviewer was developed with MCMP support to the Superior Watershed Partnership

(SWP) and partners at Applied Ecological Service (AES) and 906 Technologies, and can assist coastal management, restoration, planning, and outdoor recreation.

- Historic Shoretypes in Michigan - Data Development: MCMP supported the Michigan Natural Features Inventory's 2018 project entitled *Spatial Data to Improve Coastal Resiliency and Better Inform Local Decision Making.* Geospatial data layers showing the extent and characteristics of coastal dune systems were developed along with a digital layer showing an historic (circa 1950's) inventory and assessment of Michigan's Great Lakes coastal geomorphology. The historic hardcopy (mylar) maps, known as the Humphrys shoretype classification, were converted into a digital GIS data layer. Historic beach and nearshore parameters such as beach width, slopes, sediment type, and erosion potential qualifiers can help local communities better understand which areas have had higher potential for shoreline erosion, potentially resulting in lower risk for new developments within the coastal boundary, while also identifying potential risk to existing infrastructure.

While beach erosion and coastal flood challenges are currently high-priority coastal hazards, challenges associated with swimmer safety from dangerous nearshore currents continue to be a concern. According to the Great Lakes Current Incident Database (https://www.michiganseagrant.org/dcd/dcdsearch.php), since 2015 Michigan's Great Lakes waters have seen 15 fatalities and 55 rescues associated with dangerous nearshore currents. The Great Lakes Dangerous Nearshore Currents Dashboard developed by researchers at MTU, identifies stretches of the Lake Michigan and Lake Superior shoreline most prone to rip currents and other dangerous nearshore currents. Application of a model to semi-automatically detect and map geo-indicators for dangerous nearshore currents was applied to a time sequence of aerial photographs. Mapping of dangerous nearshore current hot spots through the dashboard informs beach managers and the public on the relative risk level existing along any stretch of the mapped shoreline.

Management Characterization:

Coastal hazards management occurs at federal, state, and local levels of government. Private landowners also serve as critical decision-makers with respect to development and management of coastal ecosystems and hazards.

The tables and narrative below provide information on coastal hazards-related management actions employed in Michigan along with changes since the last assessment as related to changes in hazards statutes, regulations, policies, or case law; changes in hazards planning programs or initiatives; and changes in hazards mapping or modeling programs or initiatives. State statutes, regulations, policies, and case law have not significantly changed since the last assessment; however, resource changes have affected implementation, especially with respect to permits for construction of shore protection structures and coastal development in regulated areas.

Topic Addressed	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Elimination of development/redevelopment in high-hazard areas	Y	Y	N
Management of development/redevelopment in other hazard areas	N	Y	N
Climate change impacts, including sea level rise or Great Lakes level change	N	Y	N

Table 6: Significant Changes in Hazards Statutes, Regulations, Policies, or Case Law

The WRD regulates construction of shore protection structures under Part 325 of the NREPA. The WRD issued 730 shoreline protection permits in fiscal year 2018, compared to 636 the previous year. The 2018 total is nearly three times the number that were processed five years ago, when 264 were issued. Due to demand from property owners and significant erosion impacts and the threat of significant, imminent damage to development along the coast, starting in 2019, the WRD began expediting permits for shoreline protection. In cases where homes or infrastructure are at risk, permits may be issued in a matter of days. The WRD also diverted resources from other programs to assist property owners, local governments and technical professionals in processing permits; prioritizing response activities based on the risk to public health and safety; and finding appropriate solutions that protect people and the environment.

The WRD launched its new webpage, Michigan.gov/HighWater (https://www.michigan.gov/egle/0,9429,7-135-3313_3677_3702-511151--,00.html), where property owners can find information, links to helpful topics, begin the permitting process, and search a list of contractors as well as find tips for selecting a contractor who can perform the intended work. While these efforts assist property owners needing to protect their development, the long-term outcome will be increased armoring along Michigan's Great Lakes coast thereby further reducing the amount of sand available to the littoral system, which is necessary in order to sustain beaches.

Part 323 of the NREPA, provides the WRD the ability to regulate HREA and flood risk areas (FRA). The main objective for the regulations is to provide protection from the natural hazards of coastal erosion and flooding as well as environmental protection of our fragile coastal areas. The WRD reviews permit applications from property owners seeking to construct permanent structures, additions, and waste-handling facilities, including septic systems, in designated HREA along Michigan's coast. HREA are defined to be areas on the coast that are found to be receding at a rate of or greater by one foot annually. Recession rates fluctuate with water levels, storm events, freeze/thaw cycle and the impacts of people. Initial recession rate studies were conducted between 1980 and 1986 which compared historic and modern bluff

lines to determine a rate of recession. HREA were identified in 36 of the 41 counties touching the Michigan's coastline in this initial research phase.

Recession rate studies that form the basis for coastal construction setbacks require the comparison of the landward edge of the zone of active erosion on historical and modern aerial imagery. Recession rate studies are updated on a county-by-county basis. Baraga, Keweenaw, Mackinac, and Schoolcraft Counties were studied since the last Assessment. As shown in the table below, these counties included:

County	**Baraga**	**Keweenaw**	**Mackinac**	**Schoolcraft**
HREA shoreline length prior to Study (mi)	5.0	4.0	2.9	0.6
HREA shoreline identified in study (mi)	2.6	0.6	0.5	0
Change in HREA length (mi)	-2.4	-3.4	-2.4	-0.6
# parcels designated prior	58	104	17	2
# parcels designated in update study	32	6	5	0
Change in # parcels designated	-26	-98	-12	-2
Highest Rate of Recession (Update Study)	2.4 ft/yr	1.2 ft/yr	3.0 ft/yr	< 1.0 ft/yr

Table 7: County Recession Rate Studies

Approximately 224 miles (6.8%) of Michigan's 3,288 mile-long Great Lakes coastline is documented as receding at a rate of one foot per year or greater, and therefore is subject to coastal construction setbacks implemented through the HREA program under Part 323 of the NREPA. This represents a reduction of approximately nine miles of shoreland receding at a rate greater than one foot per year as compared to the 2015 assessment, which identified a total of 233 miles of shoreland above the threshold rate. A reduction of HREA mileage is surprising during a time of rising Great Lakes water levels and an increase in reported erosion impacts along the coast. The timing of the aerial photographs utilized in the studies as well as the erosion reference feature (dictated by administrative rule) that is tracked through time likely play a significant role in these results.

Buildings located in many low-lying areas along the coast have been repeatedly damaged by coastal flooding. Approximately 300 miles of Michigan's Great Lakes mainland is subject to

coastal flooding. All mapped floodplains, including those along the Great Lakes coast, are regulated by the local communities under the State Building Code. The current building code in Michigan requires that new construction or substantially improved buildings within the 100-year floodplain have the lowest floor, elevated at least one-foot above the 100-year flood elevation. The requirements and standards for flood-resistant construction within the building code result in every Michigan community having floodplain construction regulations which are considered by FEMA to comply with the minimum National Flood Insurance Program (NFIP) regulatory construction criteria. In addition, permits are required for certain construction, fill or alteration activities within the floodplain under Part 31, Water Resources Protection and Part 323 of the NREPA.

Additionally, Michigan participates in the NFIP, with coordination at the state level housed within WRD. NFIP regulations require that the most recently published FIRM and Flood Insurance Study (FIS) be used as the basis for regulation. FEMA's Great Lakes Coastal Flood Study is producing updated DFIRMs for coastal counties around the Great Lakes. The updated coastal flood study will provide a better estimate of coastal flood hazards and risk for much of Michigan's Great Lakes. The FIRMs produced by FEMA, including updated DFIRMs, through the Great Lakes Coastal Flood Study, once made effective, serve as the controlling maps identifying areas managed under the state's building code and regulations. Local communities are required to update local ordinances to incorporate the updated flood maps once they are made effective.

The Emergency Management and Homeland Security Division, Michigan State Police administer Michigan's Hazard Mitigation Plan, which assesses the state's vulnerability to various natural hazards. The MCMP contributed to the plan, which was last updated in April 2019. The plan's recommendations provide the framework and foundation for hazard mitigation activities within the State of Michigan, in accordance with planning requirements set forth in the federal Disaster Mitigation Act of 2000. Flooding is listed as a "Top" priority, with many damaging incidents referenced including urban, riverine, and coastal. Great lakes coastline hazards are "High" priority with mention of High lake levels, harmful algal blooms, and casualties from dangerous currents.

The following table summarizes changes in coastal hazards planning programs or initiatives since the last Section 309 Assessment.

Topic Addressed	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Hazard mitigation	Y	Y	Y
Climate change impacts, including sea level rise or Great Lakes level change	N	Y	Y

Table 8: Significant Changes in Hazards Planning Programs or Initiatives

The MCMP is currently in its fourth year of implementing the Resiliency Strategy. It is designed to foster improved coastal hazards planning and management at the local level. The MCMP formed a Coastal Resilience Team (CRT) whose primary partners include the UM, MTU, LIAA, Michigan State University (MSU), MAP, Michigan Sea Grant (MSG), Michigan Environmental Council, and USACE. The CRT was formed to provide input to the MCMP in the development of tools local officials can use to infuse coastal hazards risks and vulnerabilities into their local planning and zoning efforts. Early efforts show promise towards transforming coastal hazards management into more of a shared-management model where local governments have increased knowledge and commitment to play an active role.

Anticipated program changes related to the Resiliency Strategy include an MCMP policy with accompanying guidance document for local decision-makers for resilient master plans and ordinances. Anticipated outcomes include improved ability for local officials, property owners, and others to gain an increased understanding of the dynamic nature of the Great Lakes coast over time. Efforts will be made to increase the application of these geospatial tools into decision-making processes with respect to land use and development along the coast.

Eight communities have partnered with the MCMP and the larger coastal resilience team to date, working towards local program changes. The city of Bridgman has adopted changes within their master plan (as detailed in earlier sections) that provide a framework for stronger coastal resilience policies moving forward. The other communities are in various phases of adopting master plan updates or awaiting the opportunity to insert a resilience chapter once their community is in a position to execute their next full master plan update.

A significant advancement in mapping efforts resulting from the Resiliency Strategy is addressing Great Lakes water level changes with the Michigan Great Lakes Shorelines Throughout Time web-based geospatial tool (http://geospatialresearch.mtu.edu/czmp). This tool advances understanding and visualization of shoreline and bluff change over time. The viewer includes historic oblique and vertical aerial photographs providing users a unique perspective on how the shoreline has changed through time at the individual property scale. It shows shoreline, and where applicable bluff lines, at a range of historic water levels allowing users to see how dynamic the Great Lakes coast is over time. Coverage of the Lake Michigan/Huron shoreline and development continues, with the ultimate plan being full coverage of Michigan's Great Lakes coast.

Topic Addressed	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Sea level rise or Great Lakes level change	Y	Y	Y
Other hazards	Y	Y	N

Table 9: Significant Changes in Hazards Mapping or Modeling Programs or Initiatives

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	☒
Medium	☐
Low	☐

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Given the program assessment as presented and stakeholder engagement perspectives, the MCMP rates coastal hazards as a High priority enhancement area. High Great Lakes water levels presently have coastal communities and citizens reacting in a crisis mode to protect coastal development and property. While a few communities have proactively taken measures to protect coastal beaches and other natural systems through policy implementation (setback ordinances), the majority of our coast is experiencing rampant installation of armoring and other hard shore protection. While these efforts may protect infrastructure for a limited period of time, in the immediate future there is an undetermined, future cost in terms of impacts to Michigan's beaches, dunes, and other coastal resources.

Local officials and the public have concern about coastal hazards. The stakeholder survey conducted as part of this assessment identified the top area the MCMP should focus on to be "Increase the understanding of risk and mitigation associated with coastal hazards."

C. Public Access

Section 309 Enhancement Objective: Attain increased opportunities for public access, taking into account current and future public access needs, to coastal areas of recreational, historical, aesthetic, ecological, or cultural value. §309(a)(3).

Resource Characterization:

With the nation's longest freshwater coastline, Michigan provides world-class coastal public access. Not only does the state offer ample opportunities to access such an expansive shoreline, the coastal environments and communities are varied and vibrant, making for exceptional coastal experiences. USEPA's Beacon's database states Michigan offers approximately 544 public coastal beach access sites. A review of coastal public beach information from other resources, such as the Conservation and Recreational Lands (CARL) dataset and EGLE's Beach Guard dataset, as compared to that from Beacon, revealed discrepancies in location and extent of beaches. As indicated from data available on the USEPA's Beacon Database, the number of publicly accessible beach access sites has declined since the last assessment; however, the accuracy of this change is in question given the varying data reviewed.

The table below indicates data on public access availability within the MCMP coastal boundary.

Type of Access	Current Number	Changes or Trends	Cite Data Source
Beach access sites	544	↓	USEPA Beacon Database
Shoreline (other than beach) access sites	unkwn	unkwn	unkwn
Recreational boat (power or nonmotorized) access sites	330	↑	MDNR
Number of designated scenic vistas or overlook points	13	↓	MDNR, MDOT
Number of fishing access points (i.e., piers, jetties)	More than 130	–	MDNR
Coastal trails/ boardwalks *(Please indicate number of trails/boardwalks and mileage)*	1,453 (miles)	↑	MDNR
Number of acres parkland/open space	766 (total sites)	–	MDNR, CARL
Access sites that are Americans with Disabilities Act (ADA) compliant	716	unkwn	MDNR, MDMP
Other	-	-	-

Table 10: Public Access Status and Trends

Datasets are not available or are incomplete in terms of coastal public access sites in general, and especially for classifying access other than beach access. This is an identified data gap the MCMP needs to address. Furthermore, in addition to accurately classifying all coastal public access sites, it may be beneficial to assess private vs. public coastal access, which at this point, state-wide data is incomplete.

Since the last assessment, the number of designated scenic vistas and overlooks has decreased. The 13 designated turnouts or overlook sites include data sourced from both MDNR and the Michigan Department of Transportation (MDOT). These are based on best-available data sets; however, this compiled data set is likely incomplete and does not portray all coastal overlooks in the state.

Michigan has the second most registered motorboats in the nation and the number of recreational boating access sites has increased. Efforts are underway to include more thorough and accurate data on all boating access sites, notably nonmotorized access. Year to year, Michigan continually ranks in the top three states for registered recreational boats in the nation. The 330 recreational boating access sites within the coastal boundary are a subset of

data managed by the MDNR that is provided to the public through Michigan's Recreational Boating Information System (MRBIS), available at: (http://www.mcgi.state.mi.us/MRBIS/mapbasic.aspx). This dataset likely does not include all nonmotorized public access sites.

Abundant fishing access sites are within coastal boundary and MDNR data indicates more than 130 such sites, although the actual number of fishing access sites is anticipated to be even higher. Because of the inability to accurately report all fishing access, beyond the sites the MDNR keeps data on, and in an attempt to use best professional judgement, it is reported that there has been no change since the last assessment.

MDNR data indicates 1,453 miles of trails and boardwalk exist within the coastal boundary, which is an increase from the last assessment. This number was not readily available, like other data asked to be reported on in this assessment. This data is a subset of data, "clipped" using GIS-enabled software. Data "clipping" was used on the majority of datasets in order to provide some level of assessment on various public access components. The number of trails was not readily available from raw data or clipped data.

A comprehensive dataset is not available for American with Disabilities Act (ADA) compliant public access sites given this information was not previously assessed, and the MCMP has not tracked such data to date. Partial data was available from the MDNR in its Recreational Grants database which reflects construction grants that are required to meet ADA minimum requirements. This data was combined with applicable MCMP's low-cost construction projects.

The MDNR released the Statewide Comprehensive Outdoor Recreation Plan (SCORP, 2018) to identify outdoor recreation issues of statewide importance, assess demand for public outdoor recreation, and evaluate outdoor recreational resources and facilities. The SCORP is designed to be a broad-serving guide for all outdoor recreation activities and communities throughout Michigan. It is worth noting, that in defining Michigan's outdoor recreation system, the SCORP specifically and routinely acknowledges that the Great Lakes define the state's geography and that water resources help define the state's character. Some statewide trends observed and reported in the SCORP include identification of emerging and fast-growing sectors of the outdoor recreation industry, such as adventure racing, kayak fishing, stand-up paddle boarding, cross-country skiing, mountain and fat-tire biking, and other passive outdoor recreational activities. One reported issue of statewide importance dealt with technology. It is assessed that technology should be viewed as an opportunity to enhance outdoor experiences, provide greater access to information, and boost participation. The SCORP calls on outdoor recreation partners to embrace emerging technologies. From a socio-economic perspective, the SCORP recommends a focused effort to ensure outdoor recreational opportunities are accessible to residents and visitors of all backgrounds, abilities, means, and geographic locations. A specific emphasis is also placed on advancing recreational opportunities for youth close to home in urban areas.

Management Characterization:

Over the assessment period, no significant changes have been made to public access management through statutes, regulations, or policies; operation and maintenance of existing families; or acquisition and enhancement programs. The State of Michigan does administer acquisition as well as enhancement programs for management of public access to natural, cultural, and historic resource state-wide.

Management Category	State Employed	MCMP Provides Assistance to Locals	Significant Changes Since Last Assessment
Statutes, regulations, policies, or case law interpreting these	N	N	N
Operation/maintenance of existing facilities	N	N	N
Acquisition/enhancement programs	Y	Y	N

Table 11: Significant Changes in Public Access Management

The MCMP launched its Great Lakes Water Trails Initiative in 2013 to enhance local efforts to map, plan, and market coastal water trails. This Initiative resulted in approximately one million dollars of investments in local water trail mapping over the initiative period. Notably, the Michigan Water Trail Manual was produced as a state-wide resource, intended to provide local officials, water advocacy organizations, paddlers and citizens with the information, guidance and tools to develop a water trail in their community. The manual may be accessed at www.michiganwatertrails.org/manual.

Acquisition Programs – Coastal and Estuarine Land Conservation Program - The NOAA no longer administers the Coastal and Estuarine Land Conservation Program.

Michigan has numerous guides and Web sites for public access statewide, developed by various state, regional, and local agencies and organizations; however, there is no comprehensive guide or Web site that focuses specifically on coastal public access state-wide. The table below indicates the state does not have a publicly available public access guide.

Public Access Guide	Printed	Online	Mobile App
State or territory has? (Y or N)	N	N	N
Web address (if applicable)	N/A	N/A	N/A
Date of last update	N/A	N/A	N/A
Frequency of update	N/A	N/A	N/A

Table 12: Publicly Available Access Guide

The MCMP invests resources to enhance public access to Great Lakes maritime cultural and historic resources. The development of a 'Great Lakes Fisheries Heritage Trail' Web site serves as an access guide to everything fishers heritage and maritime culture related (http://www.greatlakesfisheriestrail.org). The Web site is meant to serve as an interactive trip planner and resource hub, organized by themes, such as things to do, places to visit, trail stories, partners and organizations, and learn more.

Additionally, with MCMP financial support, a 'Coastal Shipwrecks of the Great Lakes' Web site was created to enhance public access to nearshore shallow-water shipwrecks from Port Huron to Port Austin, Michigan (https://www.coastalshipwrecks.com). An interactive map displays detailed information on 24 shipwrecks, providing photos as well as historical and cultural interpretation for each. Verified GIS coordinates are also provided for locating with intent to enhance cross-engagement with coastal water tails.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	☒
Medium	☐
Low	☐

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Record high-water levels has negatively impacted public access to Michigan's coastline and Great Lakes waters. Shoreline erosion has shrunk or eliminated many beaches across the state. There are countless cases of public access infrastructure, such as scenic overlooks and staircases, falling into the water and access to the coast subsequently closed.

Given the program assessment as presented and stakeholder engagement perspectives, the Public Access focus area of the MCMP received a high prioritization for program enhancement based on a few key factors. There is need for comprehensive statewide data to accurately track and assess key metrics related to public access in the MCMP coastal boundary and a database to host such information. An additional need is for a public access guide specific to Michigan's coastal communities, coastal natural resources, maritime culture and history, and coastal waters.

D. Marine Debris

Section 309 Enhancement Objective: Reducing marine debris entering the nation's coastal and ocean environment by managing uses and activities that contribute to the entry of such debris. §309(a)(4)

Resource Characterization:

In the Great Lakes region, Alliance of the Great Lakes (Alliance) provides coordinated efforts to reduce marine debris on Great Lakes beaches. The MCMP has supported the Alliance for the past 10 years; specifically, during this assessment period, the MCMP has supported the Alliance with $379,762.

The table below characterizes the existing status and trends of marine debris in the MCMP's coastal boundary.

Source of Marine Debris	**Significance of Source**	**Type of Impact** (aesthetic, resource damage, user conflicts, other)	**Change**
Beach/shore litter	M	Aesthetic, user conflict, danger to wildlife (ingestion and entanglement), public health hazard (dangerous debris items such as broken glass)	--
Land-based dumping	L	Aesthetic, user conflict, danger to wildlife	--
Storm drains and runoff	M	Aesthetic, user conflict, danger to wildlife (ingestion and entanglement), public health hazard (dangerous debris items such as broken glass)	--
Land-based fishing (e.g., fishing line, gear)	M	Aesthetic, danger to wildlife (ingestion and entanglement)	--
Ocean/Great Lakes-based fishing (e.g., derelict fishing gear)	L	Aesthetic, danger to wildlife (ingestion and entanglement)	--
Derelict vessels	L	Danger to navigation	--
Vessel-based (e.g., cruise ship, cargo ship, general vessel)	L	Aesthetic, danger to wildlife, aquatic habitat impacts, water quality impacts	--
Hurricane/Storm	L	Unknown	--
Tsunami	L	Unknown	--
Other (extreme storms)	M	Aesthetic, user conflict, danger to wildlife (ingestion and entanglement), public health hazard (dangerous debris items such as broken glass)	--

Table 13: Existing Status and Trends of Marine Debris in Coastal boundary

During the assessment period, the Alliance's Adopt-A-Beach Program has resulted in over 15,775 trained volunteers; 21,635 volunteer hours; 25,053.8 pounds of litter; at 970 cleanup events. As part of these events, participants collected data on the types of litter collected. Results from the Adopt-a-Beach program during this reporting period show that an overwhelming majority of the marine debris collected is land-based and falls into one of three categories: smoking-related, food-related, or tiny trash. In 2018, eight of the top ten items found in the Adopt-a-Beach events in Michigan were recorded as being made of plastic. See details in table below.

Item	Amount
Plastic Pieces (plastic)	34,868
Cigarettes/cigarette filters (plastic)	30,985
Foam Pieces (plastic)	14,084
Bottle Caps (plastic)	7,327
Food Wrappers (plastic)	6,172
Straws/Stirrers	4,516
Cigar Tips (plastic)	4,004
Other Plastic/Foam Packaging (plastic)	1,889
Glass Pieces	1,824
Construction Materials	1,550

Table 14: Top ten items found during the 2018 Alliance Adopt-A-Beach Clean-ups

An emerging issue directly related to Great Lakes marine debris is the presence and impact of microplastics in the Great Lakes. Microplastics are defined by the NOAA Marine Debris Program as "(plastics) less than five millimeters in length. Microplastics come from a variety of sources, including from larger plastic debris that degrades into smaller and smaller pieces." Microplastics are small enough to pass though established water filtration systems (NOAA, 2018).

There are additional concerns regarding their movement and collection throughout the Great Lakes. According to The Great Lakes Land-based Marine Debris Action Plan, the University of Western Ontario investigated the distribution of plastics including microplastics in the Great Lakes and found that most of the Great Lakes microplastics can be found on the southern Canadian beaches of Lake Huron. Researchers speculate that this is because of current patterns in Lake Huron. Understanding the movement of microplastics through the Great Lakes has the potential to prioritize and target microplastic accumulation "hot spots" (Lowe, 2014).

Management Characterization:

Since the last assessment, amendments made to part 89, littering, of the NREPA, added abandoned vessels to the list of items included in the definition of "litter." Effective April 16, 2015, PART 89 prohibits abandonment OF VESSELS in "public or private property or water." It also provides details on jurisdiction, civil penalties, ownership, removal and disposal, sale, and determining the responsible party for any costs associated with an abandoned vessel. This change, which was not driven by the MCMP, did not significantly impact Great Lakes coastal resources. Likely future outcomes include greater collaboration between the EGLE, Department of History, Arts and Libraries, and Secretary of State to address vessels. Furthermore, it will help discourage additional abandoned vessels in public or private property or water (State of Michigan, 2014).

The following table indicates the level of management changes for marine debris.

Management Category	**Employed by State/Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Marine debris statutes, regulations, policies, or case law interpreting these	Y	N	N
Marine debris removal programs	Y	N	N

Table 15: Significant Changes in Marine Debris Management

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High ☐
Medium ☐
Low ☒

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The MCMP rates this enhancement area a low priority based on the assessment findings and the stakeholder engagement survey results.

E. Cumulative and Secondary Impacts

Section 309 Enhancement Objective: Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources. §309(a)(5)

Resource Characterization:

The table below indicates trends in coastal populations and housing units using National Ocean Economics Program Data on population and housing between 2012 and 2017.

	2012	**2017**	**Percent Change (2012-2017)**
Number of people	4,854,091	4,837,932	-0.33%
Number of housing units	2,279,203	2,299,090	0.87%

Table 16: Trends in Coastal Population and Housing Units

The number of people living in Michigan's coastal counties dropped by more than 16,000 or 0.33% during the 2012-2017 timeframe, continuing an overall trend of population decline discussed in Michigan's 2016-2020 assessment. However, compared to the 3.98% drop in coastal county population documented in the previous assessment, the rate of decline has slowed.

Within the statewide trend of decline are two regional trends. In a continuing trend in southeast Michigan, Wayne County again experienced the largest population drop of any coastal county, losing 40,457 people, while the adjacent coastal county to the north, Macomb County, experienced the largest population increase of any coastal county during the same period, gaining 22,623 people. A trend that is new to this assessment period is the population growth of most counties on the Lake Michigan coast of the Lower Peninsula relative to coastal counties elsewhere; of the 14 counties in this region, 11 had small population gains. Gains ranged from 46 people in Antrim County to almost 16,000 people in Ottawa County. With the exception of Macomb County, all other coastal counties in Michigan lost population.

Using reports from NOAA's Land Cover Atlas, the following table indicates the status and trends for various land uses in the state's coastal counties between 1996 and 2016.

Land Cover Type	**Land Area Coverage in 2016 (Acres)**	**Gain/Loss Since 1996 (Acres)**
Developed, High Intensity	110,065	12,579
Developed, Low Intensity	630,423	40,024
Developed, Open Space	274,305	36,919
Grassland	799,848	2,808
Scrub/Shrub	874,917	321,584
Barren Land	142,335	3,172
Open Water	4,125,689	-6,217
Agriculture	4,288,042	-75,745
Forested	7,390,857	-373,277
Woody Wetlands	4,688,779	-33,178
Emergent Wetlands	612,833,	60,857

Table 17: Distribution of Land Cover Types in Coastal Counties

	1996	**2016**	**Percent Net Change**
Percent land area developed		N/A	N/A
Percent impervious surface area		N/A	N/A

Table 18: Development Status and Trends for Coastal Counties

Land Cover Type	**Areas Lost to Development Between 1996-2016** (Acres)
Barren Land	N/A
Emergent Wetland	N/A
Woody Wetland	N/A
Open Water	N/A
Agriculture	N/A
Scrub/Shrub	N/A
Grassland	N/A
Forested	N/A

Table 19: How Land Use Is Changing in Coastal Counties

Placement of fill, dredging, and similar activities involved in the installation of shoreline armoring, docks, and other structures on the coast of Michigan's Great Lakes, below the ordinary high-water mark, require a permit issued under Part 325 of the NREPA. Generally, a small proportion of the Part 325 permits issued are for the removal or replacement of a shoreline structure; however, most are for new construction. Therefore, the number of Part 325 permits issued annually provides an approximate indication of construction of new structures directly on the coast. Over the past five years the number of Part 325 permits issued annually has tripled, from 160 permits in the State's 2014 Fiscal Year, which ran from October 1, 2013, through September 30, 2014, to 484 permits in the 2018 Fiscal Year. It is important to note that water levels of Michigan's Great Lakes rose significantly from below-average levels at the beginning of this period to above-average levels at the end. A rise in lake levels is associated with increased shoreline erosion by wind and wave action. Increased shoreline erosion, in turn, leads many lakefront property owners to install seawalls and other types of shoreline armoring in an attempt to protect their homes and other structures.

The 2017 State of the Great Lakes (SOGL) report addressed status and trends in riparian forest cover in each of the Great Lakes watersheds as measured by satellite imagery. The satellite imagery data examined for the U.S. watersheds dated from 2006 and 2011. The riparian zone was defined as lands within 100 meters (approximately 328 feet) of a waterbody. Forest cover in the riparian zone varied, with the U.S. Lake Superior watershed having the highest level in 2011 at 86%, followed by the Lake Michigan watershed at 62%, Lake Huron watershed (which lies entirely within Michigan) at 56%, and Lake Erie watershed at 35%. The 2011 levels were all within 1.1% of the levels measured in 2006; however, the researchers cautioned that the relatively brief timeframe between the two sets of data did not support a reliably conclusive statement about trends over time. Geographic trends were apparent in the data for Lake Michigan and Lake Huron. For the portions of these lake basins in Michigan, northern watersheds had much higher rates of riparian forest cover than watersheds in the south. The researchers concluded there is potential in the southern watersheds for impairments in water quality and ecosystem integrity from loss of riparian forest cover to development and agriculture.

Percent of riparian forest cover is an indicator of water quality and aquatic ecosystem health in rivers, lakes, and streams; generally, the greater the percentage of riparian forest cover, the lower the loadings of nutrients and other non-point source pollutants in the water body. Forest cover within a riparian zone also increases groundwater infiltration and reduces surface water temperature, with positive effects on aquatic life.

The 2017 SOGL report also contained an analysis of trends in flashiness of major Great Lakes tributaries, as measured by flow data collected by the U.S. Geological Survey beginning in the 1990s or earlier, in some cases as early as the 1950s. Flashiness of a river refers to the timing and magnitude of changes in flow relative to precipitation or snowmelt events. As the land area draining into a river loses natural vegetation cover and impervious surfaces increase, more stormwater runoff flows more rapidly into the river and temporarily increases river flow. This often has negative impacts on riverbank stability, non-point source pollutant levels, water temperature, and health of the aquatic ecosystem. Consequently, changes in flashiness indicate how land use changes and stormwater management practices affect hydrology and riverine ecosystems. The Michigan tributaries examined in the Lake Michigan Basin are the Grand River, Muskegon River, White River, Pere Marquette River, Manistee River, and Escanaba River. Tributaries examined in the Lake Huron Basin are the Saginaw River, Au Sable River, and Thunder Bay River. The River Raisin is the only Michigan tributary examined in the Lake Erie Basin. No Michigan tributaries to Lake Superior were included in the analysis.

The analysis showed that the flashiness of Michigan's Lake Huron and Lake Erie tributaries either did not significantly change or decreased over the period examined. The results were mixed for the Lake Michigan tributaries, with four of the rivers exhibiting an increasing trend in flashiness and the other two, the Grand River and Escanaba River, showing a decreasing trend. The researchers called particular attention to the Muskegon River, which had trended towards decreasing flashiness from the 1950s until the mid-1990s, when flashiness increased substantially. According to the researchers, the Muskegon River is one of three Great Lakes tributaries that warrant close monitoring for continued deteriorating trends. It is important to note that since this study, Great Lakes water levels have increased to record levels and from November 2018 to October 2019 has been declared the wettest water year on record across Michigan. These conditions are causing increased soil saturation and runoff throughout the coastal boundary leading to increased flashiness throughout the coastal zone.

Management Characterization:

Management Category	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	No	Yes	No
Guidance documents	No	No	No
Management plans (including SAMPs)	No	No	No

Table 20: Significant Changes in Management of Cumulative and Secondary Impacts of Development

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	☐
Medium	☒
Low	☐

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Given the program assessment as presented and stakeholder engagement perspectives, the MCMP rates Cumulative and Secondary Impacts as a Medium Priority Enhancement Area: increased shoreline armoring, increased flashiness throughout the coastal boundary, and modest growth in housing throughout the coastal boundary.

F. Special Area Management Planning

Section 309 Enhancement Objective: Preparing and implementing special area management plans for important coastal areas. §309(a)(6)

The CZMA defines a special area management plan (SAMP) as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal boundary. In addition, SAMPs provide for increased specificity in protecting natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making."

Resource Characterization:

The table below identifies geographic areas in the MCMP coastal boundary subject to use conflicts that may be able to be addressed through a SAMP.

Geographic Area	**Opportunities for New or Updated Special Area Management Plans** Major conflicts/issues
None	N/A

Table 21: Areas subject to use conflicts that may be addressed through a SAMP

No specific geographic areas are currently identified as well-suited for the development of a SAMP. The MCMP is structured such that program issue areas (e.g., coastal wetlands, public access, coastal hazards) remain of primary focus rather than specific geographic regions of the coast. No SAMP efforts are currently being conducted by the MCMP.

Management Characterization:

The table below indicates the approach employed by the state and if any significant changes have occurred.

Management Category	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
SAMP policies, or case law interpreting these	N	N	N
SAMP plans	N	N	N

Table 22: Significant Changes in Special Area Management Planning

Michigan has not developed or adopted a SAMP, and it is not believed that SAMP development is warranted at this time.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

   High ☐
   Medium ☐
   Low ☒

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The MCMP rates this enhancement area as a low priority based on the assessment findings, program's long-standing practice of addressing issues thematically rather than geographically (e.g., by enhancement areas rather than through SAMPs), and the stakeholder engagement survey results that did not identify any areas or regions in the state that are ripe for and in need of a special area management plan. Additional outreach about SAMPs including their application, intergovernmental coordination efforts, and opportunities may be helpful in future assessments to reevaluate whether SAMPs have new potential in Michigan; however, at present pursuing a SAMP is low priority compared to the multiple statewide high-priority enhancement areas that must be addressed.

G. Ocean and Great Lakes Resources

Section 309 Enhancement Objective: Planning for the use of ocean [and Great Lakes] resources. §309(a)(7)

Resource Characterization:

The table below indicates the status of the Great Lakes economy as of 2015.

2015	All Ocean Sectors	Living Resources	Marine Construction	Ship & Boat Building	Marine Transportation	Offshore Mineral Extraction	Tourism & Recreation
Employment	64,975	831	471	53	8,999	1,104	53,517
Establishments	3,865	104	92	32	254	151	3,232
Wages	$1,500M	$13.2M	$19.1M	$0	$577.2M	$20.1M	$848.1M
GDP	$2,700M	$35.4M	$40.9M	$0	$938.1M	$50.8M	$1,700M

Table 23: Status of Ocean and Great Lakes Economy for Michigan coastal counties (2015)

	All Ocean Sectors	Living Resources	Marine Construction	Ship & Boat Building	Marine Transportation	Offshore Mineral Extraction	Tourism & Recreation
Employment	-2.56%	+12.39%	-53.50%	-3,641.51%	-19.01%	-37.95%	+4.75%
Establishments	-3.16%	+9.62%	-17.39%	-9.38%	-2.36%	-9.93%	-2.85%
Wages	+6.67%	+59.85%	-42.93%	null	-5.61%	-28.86%	+26.93%
GDP	+7.41%	+62.71%	-37.41%	null	-6.60%	-25.39%	+29.41%

Table 24: Change in Great Lakes Economy for Michigan coastal counties (2005-2015)

Figure 1.0: Percentage of each economic sector within Michigan's Great Lakes economy (2005-2015)

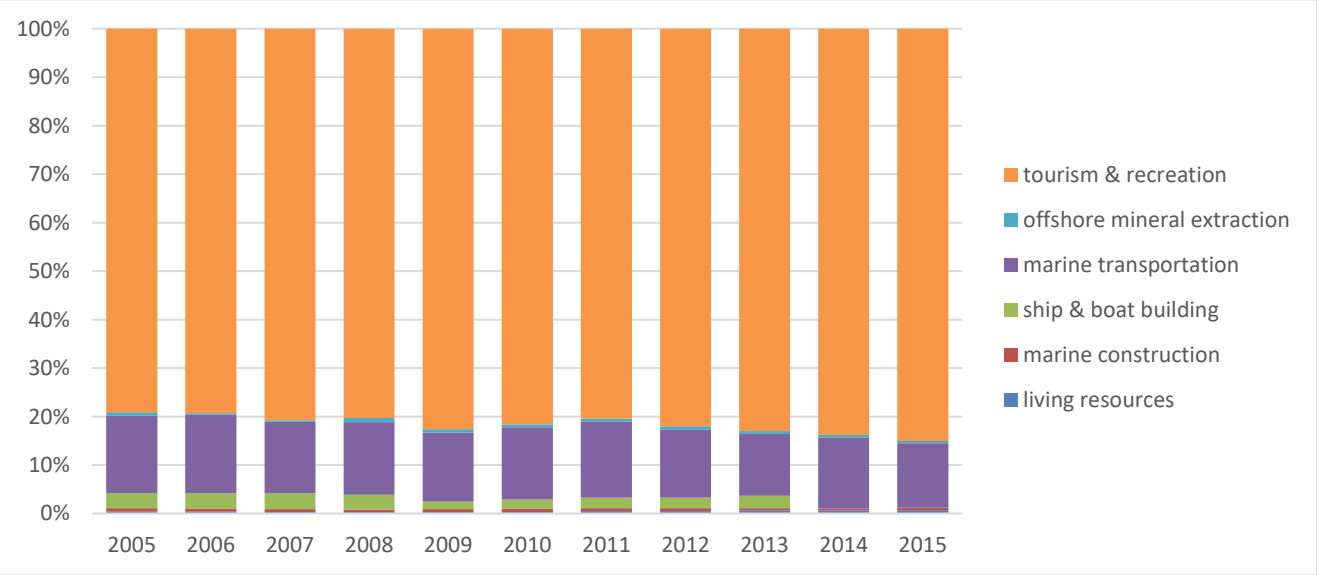


Figure 1.1: Percentage of Business Establishments for economic sectors.

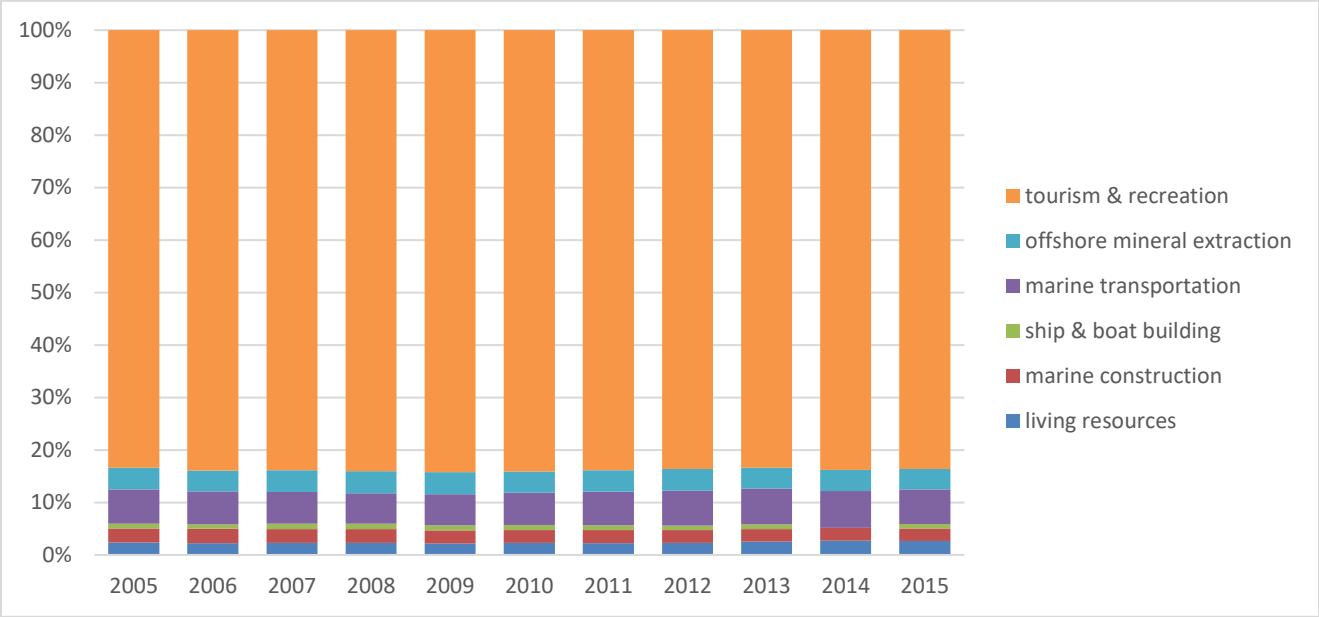


Figure 1.2: Percentage of Employment for economic sectors.

Figure 1.3: Percentage of Annual Wages for different economic sectors.

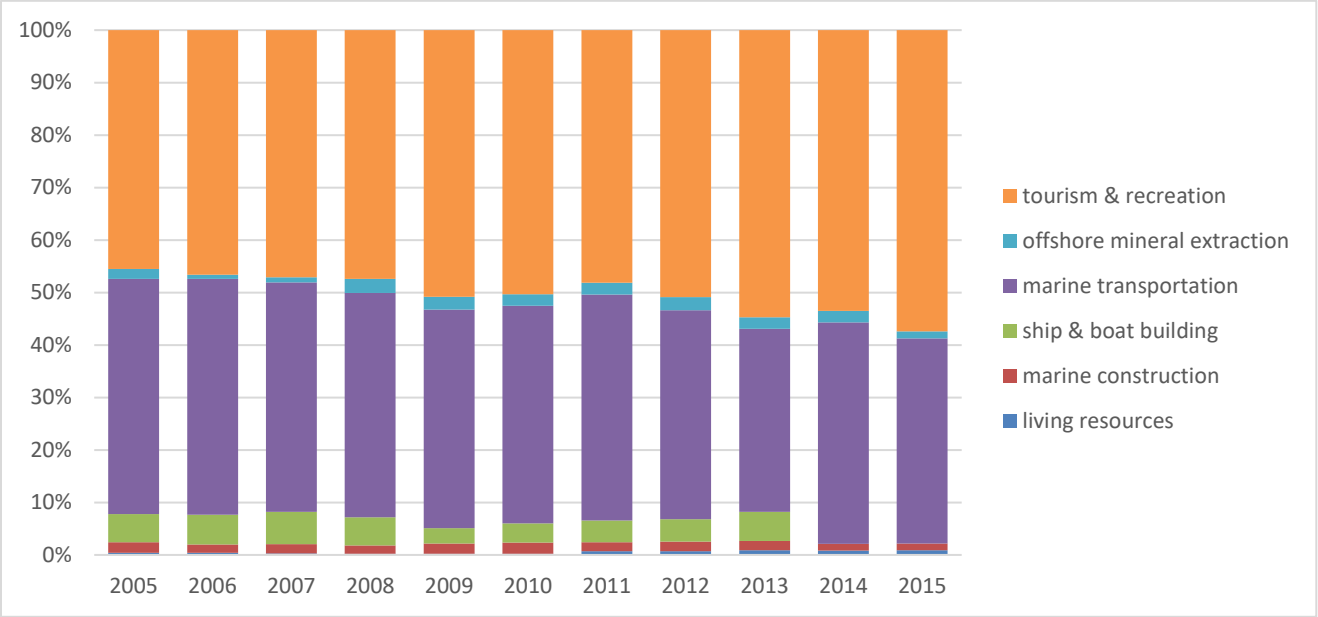
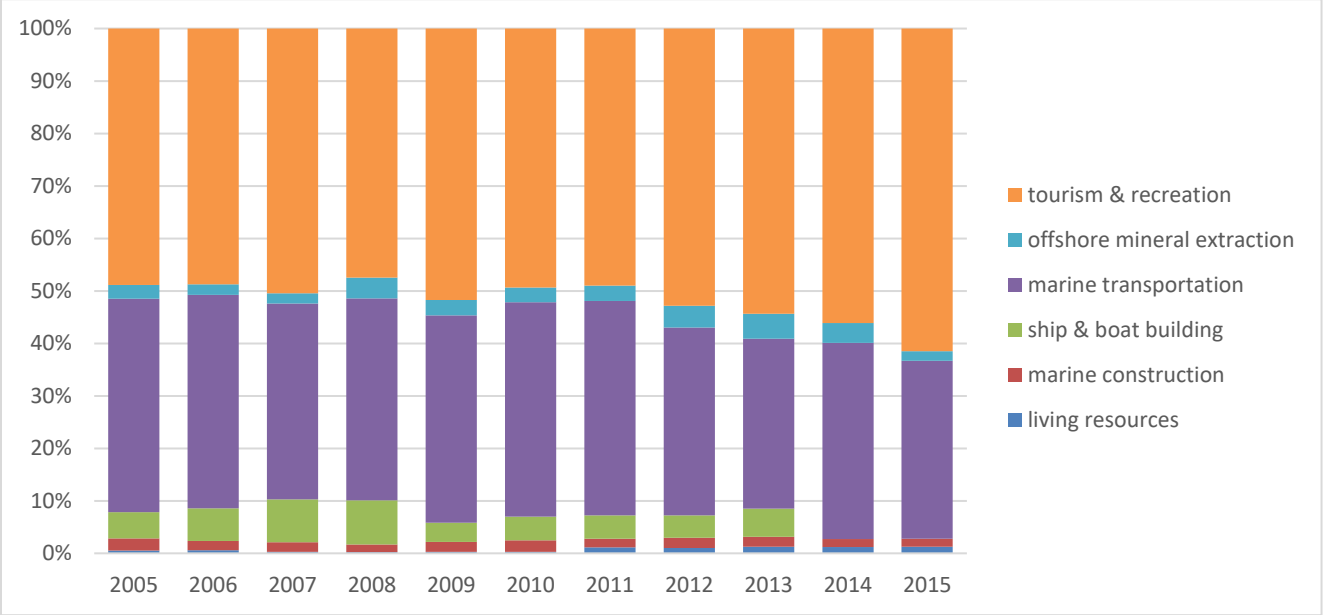


Figure 1.4: Percentage of gross domestic product (GDP) for different economic sectors.



Michigan's Great Lakes economy had a $2.7 billion annual contribution to the state's total gross domestic product (GDP) in 2015 (Table 1). Over the assessment period, from 2005 to 2015, there was varying change across each economic sector that comprises Michigan's Great Lakes economy. Factoring all economic sectors together, economic indicators for wages and GDP show growth, while downward trends were observed for the number of establishments and total employment (Table 2). Although the total number of jobs and establishments in Michigan's Great Lakes economy are slightly below the national average for other coastal

states, wages paid to those employed and the overall economic impact that is generated for the state are above the national average (Table 1; ENOW).

Tourism & recreation is a significant part of the Great Lakes economy in Michigan. In 2015, the sector accounted for 82% and 84% of total jobs and establishments in Michigan's Great Lakes economy, respectively (Figure 1.1 and 1.2). In the same year, the sector employed over 53,000 people, paid out $848 million in wages and contributed $1.7 billion to Michigan's GDP (Table 1). The number of people employed, the money they take home, and the positive impact it has on the state's overall economy are all well above the national average (Table 1; ENOW). The only notable deviance from an overall upward economic trend over the assessment period is the slight loss of establishments within the sector, at 3% (Table 2). However, this does not seem to adversely affect the economic value tourism and recreation holds in Michigan's Great Lakes economy, as evidenced by increased employment as well as increased wages and GDP contribution (Table 2). The tourism and recreation sector contribute the most economic value to Michigan's Great Lakes economy.

Another key driver of Michigan's Great Lakes economy is the maritime transportation sector. Although economic indicators within the sector depict an overall decline from 2005 to 2015, three of four indicators had a relatively minor percent change, ranging from 2% to 7%, with only employment loss exceeding that range at 19% (Table 2). Despite the downward trends, this sector is the second largest contributor to Michigan's Great Lakes economy, contributing $938.1 million in GDP in 2015 (Table 1). Additionally, Michigan's maritime transportation jobs paid above the national average in Michigan, as compared to working on the ocean coasts, with the average employee making over $70,000 in 2015 (ENOW).

From 2005 to 2015, the tourism & recreation and maritime transportation sectors contributed the most value to Michigan's Great Lakes economy (Figure 1.3 & 1.4). However, over the assessment period, economic indicators reveal noticeable trend differences that warrant further assessment (Table 2).

Living resources was the only sector to post positive trends across all economic indicators of Michigan's Great Lakes economy over the assessment period. Growth in employment, wages, and GDP outpaced the tourism and recreation sector by 2:1. Furthermore, living resources was the only sector to increase the number of establishments within Michigan's Great Lakes economy from 2005 to 2015 (Table 2). The passing of the federal Great Lakes Restoration initiative in 2010, and the subsequent annual appropriations made, may correlate to such trends in the living resources Category. This trend data warrants further assessment.

Over the assessment period, downward trends across all economic indicators in each of the marine construction, ship and boat building, and offshore mineral extraction sectors of Michigan's Great Lakes economy were observed (Table 2). Sharp declines in certain economic indicators were also observed. The number of employees that left each sector over the assessment period was high, with a 38% and 54% decline in offshore mineral extraction and marine construction, respectively, and a staggering 3,642% decline in ship and boat building (Table 2). In addition, losses of GDP were all observed above 25% (Table 2). It's worth noting that 2014 and 2015 ENOW wage and GDP data for the ship and boat building

sector was incomplete, eliminating any quantifiable assessment of economic trends. However, it can be reasonably inferred a likely significant decline occurred over the assessment period. The maritime construction, ship and boat building, and offshore mineral extraction sectors combined have a relatively minor economic impact, contributing less than 5% to Michigan's Great Lakes economy in all assessed economic indicators in each year from 2005 to 2015 (Figure 1.0).

With incomplete wage and GDP data on the ENOW database for the marine construction and ship and boat building sectors, it was prudent to seek out additional sources of information. Two recent reports provide supplemental insights into the state of Michigan's marine construction and ship and boat building economic sectors. In October 2018, the Transportation Institute issued a report on the economic impact of the shipping industry as it relates to the Jones Act. The report assessed several indicators of each sector including employment, labor income, economic output, and value added. In May 2013, the U.S. Maritime Administration, U.S. Dept. of Transportation, issued a report titled, "The Economic Importance of the U.S. Shipbuilding and Repairing Industry". Taken together, the reports provide information on operational and investment impacts; direct, indirect, and induced impacts; and jobs and wages. One specific finding was that there were 12,140 maritime jobs in Michigan in 2016, ranking 20th in nation. Furthermore, from 2011 to 2016, 3,190 jobs were added to the maritime industry in Michigan. In terms of overall contributions to Michigan's Great Lakes economy in 2016, labor income was valued at $703.6 million. Additionally, the economic impact of the maritime industry was valued at $2.8 billion annually.

It would be interesting to further assess the impacts across Michigan's Great Lakes economic sectors as it relates to the economic downturn in 2008-09 associated with the Great Recession. This current assessment covers a 10-year timeframe, 2005 to 2015. A five-year assessment timeframe would provide arguably a more accurate representation of current trends within Michigan's Great Lakes economic sectors. It is common knowledge that since 2010, Michigan has seen an economic rebound.

Type of Use	**Number of Sites**
Federal sand and gravel leases *(Completed)*	N/A (ocean states)
Federal sand and gravel leases *(Active)*	N/A (ocean states)
Federal sand and gravel leases *(Expired)*	N/A (ocean states)
Federal sand and gravel leases *(Proposed)*	N/A (ocean states)
Beach Nourishment Projects	unkwn
Ocean Disposal Sites	N/A (ocean states)
Principle Ports *(Number and Total Tonnage)*	38 ports; 35,000,000+ tons
Coastal Maintained Channels	57
Designated Anchorage Areas	7
Danger Zones and Restricted Areas	1
Other (please specify)	-

Table 25: Uses within Ocean or Great Lakes Waters

Michigan has seven Special Anchorage Areas as defined under the Ports and Waterways Safety Act, which include: Lake Macatawa, Marquette Harbor, Muskegon Lake, Lake Betsie, Charlevoix Harbor, Little Traverse Bay, and the Detroit River Belle Isle Anchorage Area. In May 2018, then Governor Rick Snyder issued an emergency rule barring anchorage within the Straits of Mackinac in response to an anchor strike on lake-bottom utilities. However, the emergency rules had a six-month expiration. Subsequently, the U.S. Coast Guard established a permanent no-anchor zone within the Straits. The no-anchor zone is an area that is approximately 40 miles wide. The east-west boundaries extend from just east of Bois Blanc Island to just west of Sturgeon Bay, with a north-south coastal boundary from about St. Ignace to Cheboygan.

The table below characterizes how the threats to and use conflicts over Great Lakes resources in the state have changed since the last assessment.

Resource/Use	**Change in the Threat to the Resource or Use Conflict Since Last Assessment**
Benthic habitat (including coral reefs)	↑
Living marine resources (fish, shellfish, marine mammals, birds, etc.)	↑
Sand/gravel	↑
Cultural/historic	unkwn
Other (please specify)	–
Transportation/navigation	↓
Offshore development	↓
Energy production	–
Fishing (commercial and recreational)	↑
Recreation/tourism	↑
Sand/gravel extraction	unkwn
Dredge disposal	↓
Aquaculture	unkwn
Other (please specify)	–

Table 26: Significant Changes to Ocean and Great Lakes Resources and Uses

The table below characterizes the major contributors to that increase.

	Land-based development	Offshore development	Polluted runoff	Invasive species	Fishing (Comm & Rec)	Aquaculture	Recreation	Marine Transportation	Dredging	Sand/Mineral Extraction	Ocean Acidification	Other (Specify)
Benthic habitat – (Buffalo Reef; other)	X			X								Stamp sands; sedimentation
Living marine resources	X		X	X	X							
Sand/gravel												High-water levels
Fishing	X		X	X								High-water levels
Recreation/tourism	X		X	X								High-water levels

Table 27: Major Contributors to an Increase in Threat or Use Conflict to Ocean and Great Lakes Resources

As aforementioned, on April 1, 2018, an anchor drag and strike occurred in a utility corridor in the Straits of Mackinac. The strike went unreported for two days, cut five high-voltage power cables, caused $100 million in damage, and released an approximated 600 to 800 gallons of mineral oil into Great Lakes waters. Also, notable, was a strike to a crude oil and liquid natural gas pipeline that supplies 25% of Michigan's Upper Peninsula propane needs, known as Line 5. As a short-term response measure, then Governor Rick Snyder issued a temporary anchorage ban in the Straits on May 23, 2018. For a long-term solution, on December 12, 2018, Governor Snyder passed PA 359 of 2018, creating the Mackinac Straights Corridor Authority (MSCA) to oversee construction of a tunnel in bedrock beneath the lakebed of the Straights to house a new utility corridor, energy, and digital transmission lines combined. An essential factor of the legislation involved the owner and operator of Line 5, Enbridge Energy Company, Inc. (Enbridge). Enbridge was to construct the tunnel with agreed MSCA oversight and State of Michigan ownership. On January 1, 2019, the State of Michigan's currently serving administration took office. On January 2, 2019, newly elected Governor Gretchen Whitmer requested a legal opinion from Attorney General (AG) Dana Nessel regarding the constitutionality of the legislation creating the MSCA. On March 28, 2019, in Opinion No. 7309, AG Nessel declared the MSCA unconstitutional. Subsequently, Governor Whitmer engaged Enbridge in good faith negotiations to find a mutually agreeable alternative for remedying concerns with Line 5 and the larger utility corridor. After negotiations failed, Enbridge filed suit against the State of Michigan on June 10, 2019. In response, on June 27, 2019, AG Nessel filed to dismiss the original lawsuit and filed a separate lawsuit against Enbridge to decommission Line 5. The counter lawsuit provides for decommissioning as soon as possible only after a reasonable and responsible plan to ensure access to energy for residents and other affected parties is identified. This is significant to the MCMP because of the impact a large oil spill would have in the Straits of Mackinac. Detrimental impacts are most likely to the natural resources on both Lakes Michigan and Huron as well as to Michigan's Great Lakes economy. A 2018 MSU study approximated an economic loss of $6.3 billion from a two-million-gallon spill in the Straits.

Another variable that impacts all economic sectors of Michigan's Great Lakes economy are the water levels of the Great Lakes. Over the course of the assessment period, the Great Lakes saw dramatic fluctuations in water levels. In 2013, water levels were extremely low. During this time, emergency dredging of harbors and shipping channels was a priority. A relatively short time later, in June 2019, the USACE issued findings (USACE, Release No. 070919-01) stating new record high monthly mean water levels were set on Lake Superior, Lake St. Clair, Lake Erie, and Lake Ontario. Lake Michigan and Lake Huron were both less than one inch from June records. This is data evidence that explains months of extensive coastal flooding around the entire State of Michigan, which led to multiple declarations of emergency by the Governor. Predicting these extreme water level functions is inherently difficult in such a large and dynamic system as the Great Lakes Basin. However, there are certain key data that lend to increased accuracy when predicting water levels, such as, winter ice cover and the amount and timing of precipitation across the Basin. As it relates to public access, high-water levels have inundated many of the beaches, harbors, and other boating access sites along Michigan's shoreline. This has led to renewed thought on how beaches and other coastal natural resources are viewed in context of the Public Trust in Michigan.

Management Characterization:

The table below indicates changes in the management of Great Lakes resources since the last assessment.

Management Category	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	unkwn
Regional comprehensive ocean/Great Lakes management plans	N	N	unkwn
State comprehensive ocean/Great Lakes management plans	N	N	unkwn
Single-sector management plans	N	Y	unkwn

Table 28: Significant Changes to Management of Ocean and Great Lakes Resources

The state of Michigan administers laws and policies for Great Lakes resource management through various mechanisms across state government. Michigan has enacted the NREPA, to protect the environment and natural resources in Michigan. Many parts of this act regulate or protect the use of the Great Lakes natural resources. The MCMP has certain approved enforceable policies that are relevant to these parts. In addition, Act 169 of 1970, Local Historic Districts Act, is also a MCMP enforceable policy related to cultural and historical

resources in the coastal boundary. The MCMP has provided assistance for local governments or communities to employ laws or policies for Great Lakes resources management, based on Act 110 of 2006, the Michigan Zoning Enabling Act. This approved enforceable policy allows the MCMP to fund projects to update zoning for local laws, regulations, or plans. The MCMP has also provided assistance for local governments or communities to develop single-sector management plans, which primarily focus on improving one topic of resources use.

Comprehensive Ocean/Great Lakes Management Plan	**State Plan**	**Regional Plan**
Completed plan (Y/N) (If yes, specify year completed)	N	N
Under development (Y/N)	N	N
Web address (if available)	N	N
Area covered by plan	N	N

Table 29: Evaluation of comprehensive Great Lakes management plans in Michigan

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

   High ☐
   Medium ☐
   Low ☒

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The MCMP rates this enhancement area as a low priority based on the assessment findings and the stakeholder engagement survey results. Michigan's Great Lakes economy is seeing a shift in sector strengths, with significant growth in tourism and living resources. Fluctuating Great Lakes water levels have put stress on certain sectors of the Great Lakes economy and natural resources, while other sectors benefit. High-water levels are destroying public infrastructure and private property. There continues to be focused attention on the chronic impact of climate change and aquatic invasive species on the Great Lakes. There are some large federal projects that will positively impact the Great Lakes economy in the near future, being upgrades to the Soo Locks and restoration of Buffalo Reef. Great Lakes resources and the Blue Economy touches every focus area of the MCMP.

H. Energy and Government Facility Siting

Section 309 Enhancement Objective: Adoption of procedures and enforceable policies to help facilitate the siting of energy facilities and Government facilities and energy-related activities and Government activities which may be of greater than local significance. §309(a)(8)

Resource Characterization:

The table below, characterize the status and trends of different types of energy facilities and activities in the state's or territory's coastal boundary based on best-available data. If available, identify the approximate number of facilities by type. For ocean-facing states and territories (not Great Lakes states), Ocean Reports includes existing data for many of these energy facilities and activities.

Type of Energy Facility/Activity	Exists in Coastal Boundary	Change in Existing Facilities/Activities Since Last Assessment	Proposed in Coastal Boundary	Change in Proposed Facilities/Activities
Pipelines	Yes – Major pipelines carrying gas and/or liquid energy fuels extend into the coastal boundary in 22 of 41 coastal counties, and a number of pipelines cross the Straits of Mackinac and Michigan's Great Lakes connecting channels	No change	No	Unknown – No major natural gas pipeline construction and operation proposals that would affect Michigan's coastal boundary have been filed with the Federal Energy Regulatory Commission (FERC) for review. Two recently completed natural gas interstate pipeline projects, the Rover and Nexus projects, extend into southeast Michigan from Ohio but do not affect the coastal boundary
Electrical grid (transmission cables)	Yes – 69 kilovolt or higher transmission lines run through most coastal counties, and electric power generating facilities within the coastal boundary are connected to high voltage transmission lines. Transmission lines cross the Straits of Mackinac, St. Clair River, and Detroit River	Increase – The last phase of a 345 kilovolt electric transmission line extension into Huron County was completed during the assessment period	Unknown – As new wind energy projects are constructed, they create or add to the need for additional or upgraded electric power transmission	Unknown
Ports	99	No change	No	No change
Liquid natural gas (LNG)	No	No change	No	No change

Type of Energy Facility/Activity (continued)	Exists in Coastal Boundary (continued)	Change in Existing Facilities/Activities Since Last Assessment (continued)	Proposed in Coastal Boundary (continued)	Change in Proposed Facilities/Activities (continued)
Oil and gas	11 natural gas-fired power plants; 6 power plants in coastal communities use petroleum in the fuel mix	Increase – At least four new gas-fired power plants, two of which are former coal-burning facilities	Yes	Increase, including a 1,150 MW gas-burning facility in St. Clair County, scheduled to begin operation in 2022
Coal	11	Decrease	No	Coal-burning units with a combined generation capacity of 2,323 MW in coastal communities are scheduled for retirement between 2020 and 2023
Nuclear	3 facilities comprising 4 power reactor units	No change	1 new power reactor unit is authorized, but there are no current plans to construct	Decrease - 1 operating power reactor unit is proposed for closure in 2022
Wind	22 utility scale wind farms operate in coastal counties with the capacity to generate 1,500 MW; however, few or no turbines are located within the coastal boundary	Increase in coastal counties, no change in coastal boundary	2 new wind farms proposed, one each in Tuscola and Delta Counties	Unknown
Wave	No	No change	No	No change
Tidal	No	No change	No	No change

Type of Energy Facility/Activity (continued)	Exists in Coastal Boundary (continued)	Change in Existing Facilities/Activities Since Last Assessment (continued)	Proposed in Coastal Boundary (continued)	Change in Proposed Facilities/Activities (continued)
Current (river)	No	No change – The proposed Vortex Hydro Energy pilot project to study the feasibility of a hydrokinetic energy device in the St. Clair River, described in the previous Assessment, was conducted and completed in the summer of 2016	No	No change
Hydropower	Yes	Decrease – Two former hydropower dams on the Boardman River in Grand Traverse County, the Boardman Dam and Sabin Dam, were removed in 2017 and 2018	No	No change
Ocean thermal energy conversion	No	No change	No	No change
Solar	No	No	Unknown	Unknown
Biomass	Yes – a small number of power plants in coastal communities use biomass in the fuel mix	Unknown	Unknown	Unknown
Pumped Storage	1	No change	No	No change
Other – oil refineries	1	No change	No	No change

Table 30: Status and Trends in Energy Facilities and Activities in the Coastal boundary

Michigan has limited fossil fuel energy sources and imports most of its natural gas needs, almost all of its petroleum needs, and all of its coal needs. All of the nuclear fuel used for power generation comes from out of state as well. The proportion of Michigan's energy needs met by wind, solar, hydroelectric, biomass, and other renewable energy sources is small but

increasing, spurred by enactment of Public Act 295 of 2008, as amended. Act 295 requires Michigan electric power suppliers to provide at least 10% of the electricity based on retail sales from renewable sources, beginning in 2015. Michigan's electric providers subject to this requirement cumulatively exceeded this standard. Amendments made to the Act in 2016 increase the standard to 12.5% in 2019 and 2020, and to 15% in 2021. Wind energy is the single largest source of renewable energy in Michigan and accounted for almost 5% of the electricity generated in 2018. Several new wind energy projects became operational during the assessment period, and many of these are located on agricultural lands in Huron and Tuscola Counties. The amount of energy generated in Michigan from all sources exceeds the State's electricity consumption, and the surplus electricity is sent out of state.

Michigan's natural gas reserves and producing wells are concentrated in the northern Lower Peninsula, while natural gas storage fields are in scattered locations in the Lower Peninsula. In the summer months when demand for natural gas is low, large volumes of gas is delivered to Michigan and pumped into certain geological formations for underground storage, where it remains until it is withdrawn in the colder months for home heating and other uses in Michigan and neighboring states. Natural gas transmission lines run through many areas of Michigan, including most coastal counties, and an increasing number of power plants in coastal communities generate electricity by burning natural gas. In the coastal boundary, major natural gas pipelines cross the Straits of Mackinac between the Upper and Lower Peninsulas and the St. Mary's River, St. Clair River, and Detroit River into Ontario. Gas transmission pipelines cross other major rivers within or adjacent to the coastal boundary, including the Portage River, Menominee River, White River, Saginaw River, and River Rouge.

A minor portion of Michigan's petroleum needs are met by wells scattered across the Lower Peninsula, but most of the crude oil used in or transported through Michigan originates from out of state. Crude oil from Alberta and North Dakota enters Michigan from two major pipelines that are part of Enbridge Energy's Lakehead pipeline system. Enbridge Line 5 enters the Upper Peninsula from Wisconsin and runs east to the Straits of Mackinac and across to the Lower Peninsula, then south and east to cross the St. Clair River, where a complex of refineries and chemical companies is located on the Ontario shoreline south of Sarnia. The age of the Line 5 pipeline, which is more than 65 years old, and its exposure to vessel anchor strikes where it lies on or suspended over the bed of the Straits of Mackinac, have prompted calls to either shut down this segment of the pipeline or enclose it within a tunnel beneath the lakebed. Enbridge Line 6B enters the southwest Lower Peninsula from Indiana and runs diagonally northeast to cross the St. Clair River into Ontario as well. Enbridge Lines 17 and 79 branch off Line 6B to destinations in Romulus, Michigan, and Toledo, Ohio, respectively. Michigan's only oil refinery is located in the coastal boundary in southwest Detroit and refines crude oil from Canada and other sources. Gasoline, asphalt, petroleum coke, propane, propylene, and other petroleum products leave the Marathon Petroleum Company refinery via pipeline, transport truck, rail, and barge. In addition to the crude oil pipelines that cross the Straits of Mackinac and the St. Clair River, pipelines carrying refined petroleum liquids cross major waterways within the coastal boundary, including the Muskegon River, Black River, Lake Macatawa, Grand River, Saginaw River, Detroit River, and River Rouge. A Sunoco Logistics pipeline carries refined petroleum products across the St. Clair River to Sarnia, Ontario. There

are no refined petroleum liquids pipelines in the Upper Peninsula, and most of the petroleum products delivered to that region arrive by truck from terminals in Wisconsin. Bulk fuel terminals are another important component of Michigan's energy distribution system, and store large volumes of liquid fuels delivered by pipeline or marine vessel. Consequently, many bulk terminals are located at ports. Gasoline and other liquid fuels generally leave the terminals for distribution via transport truck or rail.

At one time, coal-burning power plants generated the bulk of the electricity produced in Michigan. In the past several years, legislative mandates and the economics of power generation have led many utilities to shift away from coal and toward natural gas and sources of renewable energy, continuing a trend reported in the previous assessment. Several coal-burning units at power generating facilities in coastal communities have either been retired since the last assessment or replaced with natural gas-burning units. In some cases, the utility has announced plans to retire the facility in the near future. In 2018, coal-burning power plants accounted for approximately 37% of Michigan's electricity generation. All of the coal burned in Michigan is purchased from other states, mainly Wyoming and Montana. Much of the coal imported from western states is transported by rail to ports at the west end of Lake Superior, where it is loaded onto freighters for delivery to power plants on the shores of Michigan's Great Lakes and connecting channels. Coal from eastern and western states is also delivered to some power plants by rail, though Michigan's current rail network is marked by substantial gaps in service to many areas in the northern Lower Peninsula and Upper Peninsula.

Michigan's four current and historic utility-scale nuclear power facilities comprise four operating power reactor units, the sites of two decommissioned power reactor units, and the site of a proposed new power reactor unit. All are located on the shores of the Great Lakes. DTE Energy operates the Enrico Fermi Nuclear Generating Station on the shore of Lake Erie in Monroe County. Unit 2, known as "Fermi 2," is a 3,486-megawatt licensed power reactor unit currently in operation. The site of the "Fermi 1" power reactor unit, shut down in 1972 following operational problems including a partial fuel meltdown and decommissioned in 1975, is also on the facility grounds. No spent fuel from "Fermi 1" remains onsite. DTE Energy received U.S. Nuclear Regulatory Commission (USNRC) approval of a combined licensing and operation application for a proposed "Fermi 3" power reactor unit in September 2015. However, the company has no current plans to construct the unit at the facility. Indiana Michigan Power Company operates the Donald C. Cook Nuclear Plant on the shore of Lake Michigan in Berrien County, which consists of two power reactor units; Unit 1 is licensed to generate 3,304 MW and Unit 2 is licensed to generate 3,468 MW. Entergy Nuclear Operations Inc. owns the Palisades Nuclear Plant on the shore of Lake Michigan in Van Buren County, which consists of one 2,565 MW-licensed power reactor unit. The Palisades facility is the oldest of Michigan's operating nuclear power plants and is scheduled for closure and decommissioning in 2022. Entergy Nuclear Operations Inc. also owns a portion of the historic site of Michigan's first nuclear facility, the Big Rock Point Nuclear Plant, on the shore of Lake Michigan in Charlevoix County. The reactor was shut down in 1997 and the plant was decommissioned and demolished by 2006. However, Entergy is responsible for the storage casks of spent nuclear fuel that remain onsite until the USNRC accepts commercial spent fuel for permanent storage at a federal facility.

In October 2018, America's Water Infrastructure Act of 2018 was signed into law, and authorized $922 million in federal funding for a long-awaited project to upgrade the Soo Locks in the St. Mary's River, which are within Michigan's coastal boundary. The Soo Locks consist of four parallel lock chambers, named the MacArthur, Poe, Davis, and Sabin Locks, which are part of a canal system that allows vessels to bypass the rapids in the river and negotiate a drop in water elevation of 21 feet. They are operated and maintained by the USACE.

The Locks are essential navigational infrastructure for vessels carrying taconite, coal, grain, and other cargos that travel between Lake Superior and the other Great Lakes and are widely considered critical to the national economy. The Poe Lock is of particular importance because it is the only lock that can accommodate the largest freighters operating on the Great Lakes and handles about 90% of the cargo passing through the Soo Locks complex. The major improvements authorized in 2018 involve replacing the Davis Lock and adjacent Sabin Lock, which is no longer operational, with a single Poe-sized lock. USACE is beginning design and initial construction work in 2019. The project will take at least seven years to complete, and future progress will depend on annual congressional appropriations.

Management Characterization:

The table below indicates changes that could facilitate or impede energy and government facility siting and activities that have occurred since the last assessment.

Management Category	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	N	Y
State comprehensive siting plans or procedures	N	N	N

Table 31: Significant Changes in Energy and Government Facility Management

Federal law provides for states to enforce pipeline safety regulations and inspect pipeline operators by seeking certification from and entering into agreements with the Office of Pipeline Safety (OPS) within the Pipeline and Hazardous Materials Safety Administration, U.S. Department of Transportation. Michigan is certified by OPS to inspect intrastate gas pipeline operators and enforce gas pipeline safety regulations. The work is performed by the Michigan Public Service Commission (MPSC) with federal funding support. Michigan also has an agreement with OPS to inspect interstate gas pipeline operators and determine compliance, though violations are reported to OPS for enforcement.

As reported in the previous Assessment, in 2014 the MPSC proposed revisions to its Gas Safety administrative rules, necessary for Michigan to continue to operate its gas safety

program under state and federal law. The proposed rule revisions would adopt by reference the current federal gas safety standards set forth in 49 CFR Parts 191, 192, and 199. The proposed revisions would also adopt updated technical standards and add a new administrative rule providing guidance and a timeline for removal or discontinuation of gas service lines to abandoned structures, as required by 49 CFR 192.727. The rule revisions were adopted late in this Assessment period and took effect on January 3, 2019. They comprise R 460.20101 to R 460.20606 of the Michigan Administrative Code. The revisions to Michigan's Gas Safety administrative rules were not supported with Section 306 or 309 funds.

As reported in the previous Assessment, the Michigan Petroleum Pipeline Task Force was convened in 2014, partly in response to public concerns about the condition of the aging Enbridge Line 5 pipeline which lies on or suspended over the bottomlands in the Straits of Mackinac. The Task Force was co-chaired by the Michigan Attorney General and the Director of EGLE and reviewed the status and regulation of petroleum pipelines in Michigan, and the State's preparedness to respond to petroleum spill emergencies. The Task Force issued its report in 2015 and made several unanimous recommendations. The most notable recommendation is that pipeline transport of heavy crude oil through the Straits of Mackinac should be prevented through a legal mechanism, due to the difficulty of removing heavy crude oil from open water in the event of an accidental release. The work of the Michigan Petroleum Pipeline Task Force was not supported with Section 306 or 309 funds.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High	☐
Medium	☐
Low	☒

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged. The assessment findings show significant Enhancement Area activities and trends underway in the coastal boundary. The MCMP enforceable policies address construction activities such as those involved in developing federally regulated energy projects. However, the policies do not address energy planning and the program lacks expertise, capacity, and critical partnerships in this field. The enforceable policies applied in Federal Consistency reviews adequately address construction of government facilities. Therefore, MCMP rates Energy and Government Facility Siting as a low priority for developing an Enhancement Strategy.

I. Aquaculture

Section 309 Enhancement Objective: Adoption of procedures and policies to evaluate and facilitate the siting of public and private aquaculture facilities in the coastal boundary, which will enable states to formulate, administer, and implement strategic plans for marine aquaculture. §309(a)(9)

Resource Characterization:

The table below characterizes the existing status and trends of aquaculture facilities in the state's coastal boundary based on the best-available data.

Type of Facility/Activity	Number of Facilities	Approximate Economic Value	Change
Number of facilities located in coastal boundary	0	N/A	N/A

Table 32: Status and Trends of Aquaculture Facilities and Activities

For this reporting period there are no aquaculture facilities located in the coastal boundary. The last assessment (2015) reported one licensed aquaculture facility, but the facility was incorrectly identified within the coastal boundary. The total number of facilities located within coastal counties should have been reported as 25 instead of 24. Currently, Michigan has 29 aquaculture facilities within coastal counties which is an increase from the last assessment. Overall, there was a decrease in the number of facilities located in Michigan.

As reported in the previous assessment, in the Fall of 2012, a Memorandum of Understanding between Michigan Departments of Agriculture and Rural Development (MDARD), MNDR, and EGLE was revised that defined the respective roles and responsibilities regarding the development, promotion, and regulation of aquaculture.

In 2014, MDARD was approached with two concept proposals for possible commercial net-pen aquaculture operations in the Great Lakes in Michigan. It was determined that these proposals needed further evaluation since it would be a new use within Michigan waters and bottomlands of the Great Lakes and was viewed as having the potential to be a controversial matter. The concepts were analyzed by the agencies utilizing an ecosystem management approach to evaluate the potential impacts of net-pen aquaculture as a new use within Michigan's waters and bottomlands in the Great Lakes. This approach included an ecological and environmental analysis of net-pen aquaculture and the potential impacts to Great Lake ecosystems, evaluation of regulatory requirements, social, and economic impacts.

The evaluation resulted in five reports generated examining fish health and water quality (Great Lakes Net-Pen Commercial Aquaculture: A Short Summary of the Science – October 2015), applicable regulations, rules, jurisdictions and agreements (A Regulatory Analysis of Proposed Commercial Net-Pen Aquaculture in the Great Lakes – October 2015), and the potential economic impact of commercial net-pen aquaculture in the Great Lakes (Overview of Natural Resources Values Potentially at Risk from Consequences of Net-Pen Aquaculture [October 2015], Expected Economic Impact of Cage Trout Aquaculture on Michigan's Great Lakes [October 2015], Aquaculture Industry Report from IBIS World Industry Report 111251-Fish & Seafood Aquaculture in the US [March 2015]). The reports and findings were made publicly available on MDARD's Web site, presented to nine of the 12 federally recognized Tribal Nations in a meeting held on November 2, 2015, and during a public meeting held on November 19, 2015. The input received from the meetings was summarized in a document

titled Commercial Net-pen Aquaculture in the Great Lakes Public Input and Comment dated January 28, 2016. A synthesis report was created, dated March 9, 2016, summarizing the outcomes from all the reports, provided cost estimates on resources needed to oversee commercial net-pen aquaculture facilities, and outlined several recommendations.

The report concluded with the recommendation to not pursue net-pen aquaculture in Michigan due to the following considerations:

- Due to ecological/environmental risks and uncertainties identified by the science review panel and input from the public, net-pen aquaculture posed a risk to fishery management, recreation, and tourism within Michigan.
- Both collaborating management and Tribal Nations would unlikely support moving forward with authorizing net-pen aquaculture, and any attempts to proceed would likely be challenged.
- Funding was not available under current budgets, and a new funding source would need to be identified to implement the program.
- There was no regulatory authority allowing licensing of net-pen aquaculture in the Great Lakes.

Regardless of the ability to license net-pen aquaculture, it was emphasized that permitting requirements associated with construction and operation of net-pens within the Great Lakes need to be considered in the development of any policy to avoid any conflicts with regulatory requirements and prevent encouragement of applications due to the lack of regulatory authority to license these types of operations under Michigan Aquaculture Development Act, 1996 PA 199, MCL 268.871 *et seq*.

Even though the conclusions were not recommending the pursuit of net-pen in the Great Lakes, it was indicated that the State would continue to work within statutory requirements and assist on design improvements for systems used in existing aquaculture facilities. Furthermore, as part of the efforts to support aquaculture in Michigan, MDARD, which oversees the licensing of aquaculture facilities, hosts an aquaculture webpage on its Web site providing a wide variety of resources related to owning and operating an aquaculture facility, including guidance for new facilities, licensing and regulatory requirements, fish health, funding, and financing.

Management Characterization:

As part of its continuous effort, the agencies work with the aquaculture industry and meet with industry groups regularly to receive updates on the industry and to discuss ways to navigate regulatory processes. As of these efforts to support the aquaculture industry, a “Regulatory Resource Book” was developed in August 2018, that identifies potential permits, licenses, and requirements that are applicable to installing and maintaining commercial aquaculture facilities in Michigan.

Management Category	Employed by State or Territory (Y or N)	MCMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Aquaculture comprehensive siting plans or procedures	N	N	N
Other aquaculture statutes, regulations, policies, or case law interpreting these	N	N	N

Table 33: Significant Changes in Aquaculture Management

The State does not have aquaculture comprehensive siting plans or procedures. However, MDARD provides a link under its Aquaculture webpage for two siting guidance documents developed by MSG (Site Selection Plans for New and Expanding Aquaculture Facilities in Michigan Draft 2019) and MSU (Commercial Aquaculture in Michigan Siting Guidebook dated July 12, 2018). Funding from both documents was provided by NOAA.

On January 4, 2017, the Michigan Attorney General issued opinion No. 7293 in response to a State Legislator's request on whether aquaculture was legal in the Michigan waters under the Michigan Aquaculture Development Act, 1996 PA 199, MCL 268.871 *et seq* (PA 199). PA 199 states in part that an aquaculture facility is "a farm or farm operation engaged in any aspect of aquaculture in privately controlled waters." The Attorney General's opinion concluded that net-pen agriculture in the Great Lakes was not allowable under PA 199 based on the following legal interpretation:

"It is my opinion, therefore, that the only operations that meet the definition of an "aquaculture facility" under the Michigan Aquaculture Development Act may be registered to engage in aquaculture in the State of Michigan. Under the Act, an aquaculture operation in the Michigan waters of the Great Lakes could not be registered to engage in aquaculture because the operation would not meet the current definition of an "aquaculture facility" since the Michigan waters of the Great Lakes are not "privately controlled waters" as defined in the Act."

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

   High ☐
   Medium ☐
   Low ☒

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The MCMP rates Aquaculture as a low priority based on the assessment findings and the stakeholder engagement survey results.

IV. Phase II. Assessment Findings

The MCMP ranked the high priority enhancement areas based on the Phase I Assessment findings, stakeholder engagement survey results, and consultation with the NOAA program liaison. The MCMP conducted an in-depth analysis of the Wetlands, Coastal Hazards, Public Access, and Cumulative and Secondary Impacts enhancement areas following the NOAA 309 guidance. The following section outlines the findings.

A. Wetlands

In-Depth Resource Characterization:

Invasive species continue to be a primary stressor and threat to condition, quality, and functions of Great Lakes coastal wetlands. Many new introductions and new species are first detected in coastal wetlands, often in close proximity to boat launches and recreational areas where species can be brought in on boats or other equipment. Michigan has a strong inter-agency team called the Invasive Species Core Team made up of experts from EGLE, the MDNR, MDARD, and MDOT, dedicated to implementation of the invasive species' State Management Plans. The complexity and diversity of coastal wetlands, along with their dynamic hydrologic regime and proximity to recreational activities, makes them a hotbed for new introductions and range expansion of invasive species.

Development pressure and conversion to agriculture continue to be the one of the greatest causes of overall wetland loss in Michigan, according to the report on Status and Trends of Michigan's Wetlands: Pre-European Settlement to 2005, (https://www.michigan.gov/egle/0,9429,7-135-3313_3687-10332--,00.html), and are especially significant threats in Great Lakes coastal wetlands. Loss of coastal wetlands in Michigan has not been uniform along the coast, and some parts of the shoreline have lost as much as 90% of the coastal wetlands that existed prior to European settlement. In these areas in particular, the threat of further loss due to development, shoreline management, or conversion to agriculture is of primary concern, especially during periods of low water. These areas are also particularly susceptible to shoreline erosion and deposition, increased storm severity, and other effects of climate change.

Although Great Lakes water levels are naturally cyclical with periods of low and high-water, sustained extremely high or extremely low water levels pose a significant threat to the condition, quality, and function of Great Lakes coastal wetlands. During sustained low water periods, widespread expansion of invasive species, shoreline management activities such as beach grooming, and hydrologic alterations such as diking are some of the most significant changes that occur in coastal wetlands. During sustained high-water periods, widespread erosion and shoreline armoring are among the most significant changes in coastal wetlands that can lead to degradation of condition and function. In addition, there is a secondary affect that periods of dramatic water levels have on coastal wetlands, which is to alarm people and cause them to seek short-term solutions or solutions that are not based on science. WRD works to promote sustainable management of coastal wetlands, as well as to provide

education and outreach information to the public and stakeholder groups on water levels. Nevertheless, the climate change predictions for the Great Lakes region indicate that the cycle of water level changes on the Great Lakes is changing, and that there may be more abrupt, longer, or extreme periods of highs and lows of water levels, exacerbating this threat as well as many others.

	Stressor/Threat	**Geographic Scope** (throughout coastal boundary or specific areas most threatened)
Stressor 1	Invasive species	Throughout coastal boundary
Stressor 2	Development/Agricultural	Throughout coastal boundary
Stressor 3	Great Lakes water level changes	Throughout coastal boundary

Table 34: Three most significant existing stressors for wetlands within coastal boundary

Results from the stakeholder engagement survey indicate the conservation of coastal wetlands and identified a need to provide more information and outreach to address challenges facing coastal wetlands such as changing great lakes water levels. There is a knowledge gap within communities of not fully understanding the benefits of maintaining coastal wetlands and having the resources and tools to guide them towards long-term resilience planning, including the implementation of restoration and enhancement resilient options.

As detailed in following table, two emerging issues for coastal wetlands relate to restoration and management challenges and changes to species assemblages in terms of expansion of range and composition as part of species adapting to climate change. To address these emerging issues, information is needed on how to manage restoration sites for targeted invasive species and methods to restore diversity and function while incorporating resiliency measures to support successful restoration projects. Additionally, information is also needed to better anticipate when species changes will occur and the potential effects that species expansion and changing composition may have on ecosystems in order to develop monitoring and adaptive management plans.

Emerging Issue	**Information Needed**
Restoration and management	Particularly after managing for target invasive species, how to restore diversity and function, as well as incorporate resiliency
Management for range expansion and different species assemblages, as adaptation to climate change	When and how to manage for different species assemblages, or range expansion, monitoring

Table 35: Emerging issues for wetlands within coastal boundary

In-Depth Management Characterization:

There has not been a study conducted specifically for the purpose of evaluating management efforts in protecting, restoring, and enhancing coastal wetlands since the last assessment.

However, WRD participates in workgroups using different methods to evaluate protection and restoration effectiveness throughout the Great Lakes.

WRD is a co-Principal Investigator on the USEPA funded Great Lakes Coastal Wetland Monitoring Program, which conducts intensive site monitoring of coastal wetlands throughout the basin. All of the project reports and summaries of this project are available at (https://greatlakeswetlands.org/Reports-Publications), and the USEPA Great Lakes National Program Office (USEPA GLNPO) site includes additional summarized information on major findings of this effort at (https://www.epa.gov/great-lakes-monitoring/data-and-major-findings).

In addition, WRD participates on the Great Lakes Coastal Assembly, including the Blue Accounting sub-workgroup. The Great Lakes Coastal Assembly is a multi-agency team of varied organizations working together to conserve and restore lands and waters in the critically important coastal boundaries of the Great Lakes. The Blue Accounting sub-workgroup is working to support coastal wetland restoration, enhancement, and protection efforts by providing decision-makers with a clear picture of the work and resulting impacts occurring throughout the basin through tracking investments and relevant metrics.

Management Category	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Wetland assessment methodologies	Y	N	Y
Wetland mapping and GIS	Y	N	Y
Watershed or special area management plans addressing wetlands	Y	N	N
Wetland technical assistance, education, and outreach	Y	N	N
Other (please specify)			

Table 36: Significant Changes in Wetland Management

In late 2015, WRD launched a new permitting database, MiWaters, which incorporates spatial tracking of permitted and unauthorized impacts through GIS. This was a significant change from the old database which tracked these impacts only in a database through Town Range and Section. The GIS portion of the database now serves as the primary information available to the public and other agencies on permitted impacts to Michigan's water resources, as well as provides a significant amount of spatial data and GIS tools that can be used by anyone. Since 2016, this is the database used to provide semi-annual and annual reporting for regulatory decisions to NOAA and other oversight agencies. This system has dramatically improved spatial tracking and evaluation of regulatory decisions, as well as significantly increased the amount of relevant spatial data available to aide regulatory staff in review of permit applications and compliance actions, resulting in improved decision-making. There

continue to be enhancements and improvements made to this system, and it is expected that this system will continue to become more efficient and effective in the future.

With funding support given by the USEPA, in 2016, WRD launched the first ever five-year round of statewide wetland monitoring. This effort includes a stratified random site selection from the updated National Wetland Inventory for Michigan, implementation of the National Wetland Condition Assessment in Michigan, and sampling protocols for vegetation, macroinvertebrates, water chemistry, and Michigan Rapid Assessment Method for Wetlands (MiRAM) was conducted at sites throughout the state over the past five years of which less than five sites were located within the coastal boundary. However, the random selection of sites will allow for more sites in the coastal boundary in the future. After this first five-year round, WRD intends to evaluate the study design and protocols, determine if improvements are needed, and then implement the next five-year round.

Identification of Priorities:

Management Priority 1: Planning and Implementation of Sustainable Management guidance for coastal communities on the protection of coastal wetlands.

Description: With the continued threat of invasive species, development/agricultural, and great lakes water level changes to coastal wetlands, MCMP has an opportunity to develop a technical assistance guidance for sustainable coastal wetland restoration and enhancement practices that will be used to fill the knowledge gap needed to make on-the-ground changes. Through this process the MCMP will develop key messages and promote the benefits of coastal ecosystems as identified as needed in the stakeholder engagement survey.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	• Managing for target invasive species, how to restore diversity and function, as well as incorporating resiliency for coastal wetland restoration and management • Research/compile existing and proposed restoration and resilient adaptation strategies to develop technical guidance document • Natural and nature-based coastal solutions for technical guidance
Mapping/GIS	Y	Completion of the creation of spatial predictions for coastal wetlands and the ZDCI for the Upper Peninsula, specifically for communities that border Lake Superior and the upper sections of Lake Michigan and Huron
Data and information management	Y	Public facing web-based platform for providing technical guidance on protection, preserving, and restoration of coastal wetland habitat
Training/capacity building	Y	• Provide coastal decision-makers with technical guidance for sustainable coastal wetland restoration and enhancement practices to promote long-term solutions and coastal resiliency • Strengthen knowledge, capacity, and commitment of coastal communities

Priority Needs (continued)	Need? (Y or N) (continued)	Brief Explanation of Need/Gap (continued
Decision-support tools	N	
Communication and outreach	Y	• Develop key messages to promote the benefits of coastal wetlands, including functions, values, and priority conservation opportunities • Develop communication strategy to promote technical guidance document to coastal communities to foster on-the-ground changes
Other (specify)		

Table 37: Coastal Wetlands Knowledge Gaps and Priorities

Enhancement Area Strategy Development:

1. Will the MCMP develop one or more strategies for this enhancement area?

Yes ☒
No ☐

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

Stressors such as widespread expansion of invasive species, beach grooming and hydrologic alterations in coastal wetlands, sustained high-water periods, and shoreline erosion has led to people pursuing short-term solutions without considering the immediate and long-term impacts these activities have on coastal wetlands. The MCMP will work to develop technical assistance for sustainable coastal wetland restoration and enhancement practices that will be used to fill the knowledge gap needed to make on-the-ground changes through a coordinated Adaptation Strategies Toolkit.

B. Coastal Hazards

In-Depth Resource Characterization:

Ongoing coastal erosion impacts clearly indicate the severity of the identified hazards. Coastal erosion and flooding are directly impacting coastal communities along the coast as residential homes and critical infrastructure are being undermined by erosion or inundated by floodwaters. Many coastal property owners are investing significant dollars into efforts to save their homes.

Coastal communities are seeing significant impacts of undermined coastal roads, damaged public marinas, and stormwater and sewer systems. An early, informal polling of coastal communities conducted by the Michigan Municipal League estimates local community repair costs in excess of $63 million due to recent erosion and flooding events along the Great Lakes coast. Significant time, effort, and funding is being applied to mitigate impacts to infrastructure in this crisis moment.

The stakeholder engagement survey indicates a need to increase the understanding of risk and mitigation strategies associated with coastal hazards, (e.g., erosion, flooding, coastal

storms). Input gained through the survey indicates need for applied research towards coastal hazards, and to provide tools, outreach, and technical assistance towards managing hazards and identifying alternative coastal adaptation approaches.

	Type of Hazard	**Geographic Scope** (throughout coastal boundary or specific areas most threatened)
Hazard 1	Coastal Erosion	Widespread throughout the coastal boundary, but impacts are especially prevalent along the Lake Michigan and Lake Superior coasts
Hazard 2	Coastal Flooding	coastal flooding; impacts especially prevalent along the Lake Erie and Lake St. Clair coasts along with the drowned river mouth estuaries throughout the state
Hazard 3	Dangerous Nearshore Currents	Sandy beaches with moderate slopes and well-developed sand bars are most prone to rip currents and other dangerous nearshore currents

Table 38: Characterization of coastal hazard risks in Michigan

Emerging Issue	**Information Needed**
Increasingly armored shorelines resulting in lower sediment supplies and subsequently, the loss of public beaches	Evaluation of coastal adaptation alternatives providing options other than traditional shore protection efforts, specifically in the Great Lakes setting.
Short-term erosion rates (during high-water) vastly differ from the long-term rates traditionally applied toward land use management (e.g., setbacks)	Rates of erosion that occur over the short-term during periods of high Great Lakes water levels and storms; research/modeling to better understand whether projections based on past erosion will be meaningful or if the system is changing.
Impacts to community infrastructure	Improved geospatial information on locations of critical infrastructure; enhanced information on prospective threats from erosion and flooding that may occur in association with future, changing Great Lakes water levels and wave regimes due to climate change.

Table 39: Emerging issues of concern related to coastal hazards

In-Depth Management Characterization:

No significant changes in coastal hazards statutes, regulations or policies have occurred since the last assessment. Shoreline setbacks and repair/rebuilding restrictions are provided for at the state level through Part 323 of the NREPA. Oversight of shore protection structures, including any restrictions on new/replacement structures and promotion of alternative shoreline stabilization measures at the state level, are covered under Part 325 of the NREPA. Freeboard requirements, and other flood-related issues are employed through Part 323 of the NREPA, and through state participation in the National Flood Insurance Program.

The MCMP supports coastal communities through a range of coastal hazards management categories as identified in the table below. Support is provided in the form of technical and financial assistance. Existing state policies do not require local coastal hazards management. Therefore, such actions taken by local communities is voluntary.

Management Category	**Employed by State/Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Change Since the Last Assessment** (Y or N)
Shorefront setbacks/no build areas	Y	Y	N
Rolling easements	N	N	N
Repair/rebuilding restrictions	Y	Y	N
Hard shoreline protection structure restrictions	Y	Y	N
Promotion of alternative shoreline stabilization methodologies (i.e., living shorelines/green infrastructure)	Y	Y	N
Repair/replacement of shore protection structure restrictions	Y	Y	N
Inlet management	N	N	N
Protection of important natural resources for hazard mitigation benefits (e.g., dunes, wetlands, barrier islands, coral reefs) (other than setbacks/no build areas)	Y	Y	N
Repetitive flood loss policies (e.g., relocation, buyouts)	Y	N	N
Freeboard requirements	Y	N	N
Real estate sales disclosure requirements	N	N	N
Restrictions on publicly funded infrastructure	N	N	N
Infrastructure protection (e.g., considering hazards in siting and design)	N	Y	N
Other (please specify)	N	N	N

Table 40: Significant Changes in Coastal Hazards Statutes, Regulations, and Policies

Coastal hazards are addressed to an extent within the State's Hazard Mitigation Plan, which is administered by the Michigan State Police, Emergency Management and Homeland Security Division. Otherwise, the state does not employ statewide coastal hazards management plans such as those outlined in the table below.

Management Category	**Employed by State/Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Change Since the Last Assessment** (Y or N)
Hazard mitigation plans	Y	N	N
Sea level rise/Great Lake level change or climate change adaptation plans	N	Y	Y
Statewide requirement for local post-disaster recovery planning	N	N	N
Sediment management plans	N	N	N
Beach nourishment plans	N	N	N
Special Area Management Plans (that address hazards issues)	N	N	N
Managed retreat plans	N	Y	N
Other (please specify)	N	N	N

Table 41: Significant Changes to Coastal Hazard Management Planning Programs or Initiatives

Primary coastal hazards mapping conducted by the state include the coastal recession rate studies conducted by WRD through the HREA Program. The MCMP offers funding support to local communities and regional planning entities that wish to conduct hazards mapping, shoreline change assessments, and other related education and outreach as part of their annual funding opportunities. More directly, as part of the Resilience Strategy, the MCMP provides funding support to the MTU in the development of the Great Lakes Shorelines through Time web map viewer, which constitutes a significant advance in coastal hazards mapping. This web-based map provides the public, for the first time, a view of how Michigan's shorelines and bluff lines (where applicable) change over time. The following table summarizes coastal hazards research, mapping, and education efforts.

Management Category	Employed by State/Territory (Y or N)	MCMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
General hazards mapping or modeling	Y	Y	Y
Sea level rise mapping or modeling	N	N	N
Hazards monitoring (e.g., erosion rate, shoreline change, high-water marks)	Y	Y	Y
Hazards education and outreach	Y	Y	Y
Other (please specify)	N	N	N

Table 42: Significant Changes to Coastal Hazard Research, Mapping, and Education Programs or Initiatives

In "*Overlooking the coast: Limited local planning for coastal area management along Michigan's Great Lakes"* (Norton, David, Buckman, & Koman, 2018) evaluated local coastal management efforts in Michigan. The analysis reviewed implementation through local master plans and considered local capacity, knowledge, and commitment towards managing coastal hazards. The study found that Michigan's coastal communities are largely failing to consider their coastal areas in their planning, or to adopt meaningful plan policies to manage them, for at least four reasons: (1) Damaging erosion and storm events have been relatively infrequent; (2) Localities rely on the state to address coastal issues;(3) Insurance programs effectively indemnify them when a storm does happen; and (4) Shoreland owners push back against proactive local management.

The study indicated that the hiring of additional local planning staff and providing technical training regarding coastal dynamics and hazards are promising steps to move forward. The study also pointed out that the State does not have the authority to mandate local coastal management through planning or zoning. For this reason, the State must look to other tools, such as providing funding and technical resources, that may inspire local units to act and streamline their workload in doing so.

Michigan was given a grade of "D" in the Surfrider Foundation's 2018 State of the Beach Report Card (https://www.surfrider.org/coastal-blog/entry/2018-state-of-the-beach-report-card-released). Surfrider – a non-profit community of people seeking to protect the ocean waves and beaches around the nation – released it's 2018 State of the Beach Report Card. The goal of the report card is "to make the public aware of the ever-growing erosion problem facing our beaches and improve how municipalities and agencies respond to erosion, coastal preservation, and sea level rise." While the Surfrider report represents a subjective, qualitative assessment of coastal management rather than a quantified assessment and controlled evaluation, it identifies concepts and recommendations worthy of consideration.

Sediment management, coastal armoring and development are the management areas where Michigan received a rating of "Bad." Sediment management weaknesses included a lack of regional sediment plans and policies and the lack of a beach fill policy. WRD's permitting of seawalls via a low-threshold general permit and lack of clear requirements for monitoring or

removal is identified as shortcomings with respect to coastal armoring. For management of development, the report stated that the setback regulations recession rate studies (upon which setback requirements are based) are more than 20 years old.

Pertinent recommendations in the State of the Beach Report Card included: Establishing a sand replenishment policy that includes thorough analysis of potential impacts; encouraging coastal regions to develop regional sediment management plans, prohibiting the use of seawalls, or if necessary, requiring clear conditions of monitoring and removal; and limiting construction, repair, and reconstruction of existing coastal development in hazard areas.

In *"Dynamic Coastal Shoreland Zoning: Adapting Fastland Zoning for Naturally Shifting Coastal Shores"*, (Norton R. K., 2020) advances the need for shoreland zoning that considers the dynamic nature of the coast and seeks to implement a sort of adaptive zoning that accommodates the ever-changing coast. Such advances will require increased understanding of adaptation options so that we are able to better avoid and retreat from hazards, and associated effects, in the future.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	Additional research is needed on: • Alternative, sustainable shore protection approaches in the Great Lakes setting • Changes in the littoral sediment budget due to increased use of shore armoring • Feasibility of active sand management approaches that could build protective beaches in sediment-starved locations • Effects of loading near coastal bluffs such that the weight of private septic systems, pools, and homes too close to the bluff may increase bluff failures • Expand research on the role of groundwater in coastal bluff erosion; especially potential increase in susceptibility due to effluent from private septic systems placed near bluff slopes
Mapping/GIS/modeling	Y	Needs include: • Updating coastal recession data to use more contemporary data sets and better reflect changes and impacts occurring during high Great Lakes water levels • Improved understanding of shoreline recession scenarios into the future should water levels remain elevated
Data and information management	Y	A searchable, geospatial database that fosters efficient tracking of properties designated under the state's High-risk Erosion Area Program is needed
Training/Capacity building	Y	Additional training resources for local officials to streamline efforts to train new officials and address local turn-over
Decision-support tools	Y	Visualization tools showing just how dynamic Michigan's beaches, bluffs, and dunes are - especially during high-water periods

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Communication and outreach	Y	There exists a need to develop additional communication tools, which streamline the continuous training efforts that are needed to address turnover in local officials; a community of practice approach to facilitate discussions and actions around coastal hazards is a gap that may help drive positive action
Other (specify)	N	

Table 43: Coastal Hazards Knowledge Gaps and Priorities

Identification of Priorities:

Management Priority 1: Develop a technical resource targeted towards local officials that informs and advances consideration of the full suite of resilient coastal adaptation strategies including avoidance, retreat, accommodation, and protection approaches.

Description: Improved understanding of softer alternatives in a Great Lakes setting are needed for communities, homeowners, and consultants who seek to balance between protecting coastal infrastructure and preserve beaches and dunes. Development of a Michigan-specific guidance on how to adapt to dynamic coasts and association hazards to better protect development is needed. Objectives may include: 1) evaluating feasibility of alternative shoreline management efforts such as wave reduction techniques, beach nourishment, and/or softer "gray-green" engineering approaches, and/or 2) increasing understanding of the economic impacts associated with implementing traditional shore protection approaches as compared to natural beaches.

Management Priority 2: Conduct research to reduce the need for traditional, short-term shore protection through enhanced use of coastal construction setbacks.

Description: Coastal construction setbacks could be made more effective by improving methods for calculating recommended setback distances and expanding use of locally implemented setbacks. Supporting objectives may include: 1) updating recession-rate studies to incorporate recent conditions and expand the data record, 2) updating recession-rate research methods to better reflect actual risk, 3) enhancing related data tracking systems and public-facing information, and 4) promoting local setback efforts that are science-based and provide adequate protection for development over the long term.

Enhancement Area Strategy Development:

1. Will the MCMP develop one or more strategies for this enhancement area?

Yes ☒
No ☐

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

Due to the record-breaking high-water levels, Michigan's coast is being transformed as traditional shore protections (e.g., seawalls and revetments) are being installed at an increased pace to protect coastal infrastructure and public safety. Michigan severely lacks viable options on approaches that minimize impacts and are sustainable long-term solutions. Alternative approaches for nature-based solutions that are long-term and sustainable strategies on the Great Lakes setting are not well known; therefore, a comprehensive set of adaptation approaches are greatly needed.

C. Public Access

In-Depth Resource Characterization:

Record high-water levels is a Great Lakes basin-wide stressor and has resulted in significant negative impacts along a great deal of Michigan's coastline. Shoreline erosion and coastal flooding are the most prevalent and destructive forces on coastal public access. These impacts negatively impact citizens' and visitors' ability to access and enjoy Michigan beaches and other coastal resources. Furthermore, it is a waste of taxpayer money when publicly funded coastal public access sites are developed or enhanced only to be washed away during high-water storm events. In response to Great Lakes high-water levels, WRD has prioritized coastal resource protection permitting beginning October 2019. Although a necessary response, increasing hardened shoreline protection exacerbates erosion of beaches and other shoreline natural features where the protection terminates, pushing the problem off to another individual or public entity. In the long term, cumulative impacts from hardened shoreline protection serves to undermine providing coastal public access and the protection of coastal public trust resources. According to the USACE, water levels in the Great Lakes are likely to continue to rise and surpass record highs across all lakes in the near future.

	Stressor/Threat	**Geographic Scope** (throughout coastal boundary or specific areas most threatened)
Stressor 1	High-water levels	Throughout coastal boundary
Stressor 2	Coastal development	Throughout coastal boundary
Stressor 3	Invasive species	Throughout coastal boundary

Table 44: Top three stressors and associated geographic scope impacting Great Lakes public access

In addition to stressors from high-water and increased hardened shoreline protection, Michigan will be experiencing continued development and growth directly on the coast and in the greater coastal boundary. Population change data available at the county level provides a certain level of insight but doesn't directly correlate to development on the coast. Understanding where coastal development is likely to expand and at what pace is a knowledge gap, especially at the coastal community scale. Better communication to all stakeholders in regard to information on impacts to coastal public access resulting from high-water levels, increased coastal development, and other coastal hazards, as well as wise management strategies, is needed.

Invasive species, both terrestrial and aquatic, are a chronic stressor in Michigan's Great Lakes waters and coast. Fortunately, the ELGE and MDNR have designated grant programs specifically to address invasive species management. The prevention and control over Asian carp, and other species of non-native carp, are a major focus of the state's management effort. Additionally, aquatic invasive vegetation continues to be a problem at state or local harbors, marinas, and boat launches. It is difficult to enforce the "clean, drain, dry" and "play, clean, go" best management practices during vessel haul-out and transport. An extensive and effective public education campaign is targeted for these efforts. Quagga and Zebra mussels and Sea Lamprey are invasive, non-native species that continue to influence the ecosystems of the lakes.

Emerging Issue	**Information Needed**
High-water levels	Accurate, local-scale public access data and inventory. The MCMP needs to truly understand what public access exists, impacts already realized, and assess what is vulnerable in future due to high (or low) water impacts. This will also help the MCMP report consistent, reliable data in future assessments
Intense storms impacting public access sites	Technical guide for constructing sustainable and resilient coastal public access sites

Table 45: Emerging issues and information gaps related to Great Lakes public access

In-Depth Management Characterization:

Although various state agencies plan for public access management, collect and host GIS-based data for mapping, and provide public access technical assistance, no single state entity deals with the scope and scale required of the MCMP, specific to Michigan's coastal communities and coastal resources.

Management Category	**Employed by State/Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Comprehensive access management planning	Y	Y	N
GIS mapping/database of access sites	Y	Y	N
Public access technical assistance, education, and outreach (including access point and interpretive signage, etc.)	Y	Y	N
Other (please specify)	-	-	-

Table 46: Significant Changes to Public Access Management

The MCMP is not aware of any studies that illustrate the effectiveness of the state's management efforts in providing coastal public access since the last assessment. In working though this assessment, it is evident that complete, precise, and accurate data on coastal public access locations and associated attributes is lacking at the local scale. Furthermore, the absence of a consolidated, centralized database causes additional challenges in assessment and management efforts.

Identification of Priorities:

Management Priority 1: Develop a Michigan coastal public access inventory and guide.

Protecting and maintaining coastal public access in Michigan was an identified priority from the engagement survey. To achieve this, sufficient information and accessible data is needed on coastal public access locations. Such data would be collected and curated in an inventory and hosted on a publicly accessible database. This will lead to a better understanding of the totality of coastal public access in Michigan as well as help prioritize management efforts. Subsequent from the information gathering, a public-facing coastal public access guide would be developed.

Management Priority 2: Develop technical guidance on sustainable and resilient coastal public access site development.

Both low and high Great Lakes water levels negatively impact coastal public access sites through different means. Although public access may primarily be for use and enjoyment of coastal resources, many times there are also resource protection benefits. Siting and developing coastal public access sites with sustainable and resilient principles is necessary on the dynamic Great Lakes shoreline. To do this, technical guidance will be developed for coastal communities that advances best practices for sustainable and resilient coastal public access site development. Guidance will incorporate information and resources as it relates to proper site selection, in general, and address design, management, and maintenance for a variety of site enhancement elements, such as boat launches, docks, boardwalks, and overlooks. The guidance would be a tool utilized as construction standards for low-cost construction projects funded by the MCMP.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	• Resilient coastal development practices- small to medium scale development. This may include researching the properties and effectiveness of shoreline armoring • Research/compile existing and proposed coastal management retreat programs as well as coastal buy-out programs • Natural and nature-based coastal development and protection solutions

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Mapping/GIS	Y	• Produce new products from newly gathered data and information to develop GIS-compatible datasets and data layers for internal tracking and assessment as well as public-facing guides
Data and information management	Y	• Gathering accurate (statewide, regional, and local scales) public access, public lands, and other related data
Training/Capacity building	Y	• Educate local decision-makers and landowners about their roles in coastal management, coastal development, and protecting beaches and other public trust resources for public access and shoreline protection • For internal MCMP staff to become subject area experts in sustainable public access, low-impact development techniques, and nature-based resilient construction
Decision-support tools	Y	• Consolidating information and providing updated guidance for regulatory and coastal land management professionals on protecting public trust resources in permitting and coastal development decisions. Consistency is required in a decentralized resource permitting structure
Communication and outreach	Y	• Provide a publicly facing coastal public access guidebook and other public engagement tools from data mentioned in the Mapping/GIS priority need
Other (specify)	-	-

Table 47: Priority needs and brief explanations relating to Great Lakes public access management.

Enhancement Area Strategy Development:

1. Will the MCMP develop one or more strategies for this enhancement area?

Yes ☒
No ☐

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

Public access to the Great Lakes clearly emerged as a priority focus from assessment findings and the stakeholder engagement survey. The MCMP's public access focus area will improve the collection, management, and distribution of coastal public access data at the local scope and scale through its general Section 306 work duties. The MCMP will work to address the issue of establishing technical assistance as it relates to resilient public access structures that can withstand the highs and lows of the Great Lakes water levels.

D. Cumulative and Secondary Impacts

In-Depth Resource Characterization:

While the population of Michigan's coastal counties continues to decline, a few counties have made small or modest population gains, most of them on the Lake Michigan coast. Despite the slow or stagnant population growth, land use continues to change. The most notable consequence of land use changes during the past few decades is the increase in the flashiness of the flow of certain tributaries.

	Stressor/Threat	**Coastal Resource(s)/Use(s) Most Threatened**	**Geographic Scope** (throughout coastal boundary or specific areas most threatened)
Stressor 1	Loss of riparian forest cover, increase in river flashiness	Aquatic habitat and water quality in coastal rivers	Muskegon River, White River, Pere Marquette River, and Manistee River watersheds
Stressor 2	Increased flooding due to an increase in intensity of storm events, flashiness, and coastal development/impervious surfaces	Aquatic habitat, water quality	Throughout coastal boundary

Table 48: Significant Cumulative and Secondary Impacts Stressors

The trend of increasing flashiness in the flow of the Muskegon River, White River, Pere Marquette River, and Manistee River is discussed in the 2017 State of the Great Lakes report and described in the Phase I Assessment of Cumulative and Secondary Impacts. Flashiness of the flow of a river is related to land use in the watershed. The relationship between trends in flashiness and land cover are complex, but loss of forest cover and increase in impervious surfaces often increase flashiness, for example. Climate change may exacerbate these observed trends in river flashiness since an ongoing change in the Great Lakes region is the increasing frequency of intense precipitation events that generate stormwater runoff.

The effects of increasing flashiness are exacerbated by three factors; 1) high Great Lakes water levels; 2) higher water table throughout the coastal boundary; and 3) more intense storms due to climate change. High Great Lakes water levels and decreased infiltration (due to saturated soils) cause coastal lakes and streams to also have high-water levels. During a storm event, precipitation then quickly fills coastal lakes and streams. This effect, coupled with increased stormwater runoff from the increase in impervious surfaces in the coastal boundary, is causing an increase in flooding. With the conditions of high-water levels in the Great Lakes and connecting tributaries, increased development, high-water tables, and more frequent and intense storms combine to create a perfect storm scenario that causes increased flooding throughout the coastal boundary, a phenomenon referred to at the MCMP as increased storminess.

Emerging Issue	Information Needed
Using natural infrastructure and nature-based solutions to slow the flow and reduce flooding	How to design and implement nature-based infrastructure solutions to withstand increased "storminess" on Great Lakes tributaries How to write policies that encourage resilient nature-based infrastructure solutions

Table 49: Emerging Cumulative and Secondary Impact Issues

Currently, there is a lack of knowledge generally on techniques, methods, practices, or design/building standards tailored to addressing the unique issues facing coastal communities; specifically, to address the combined impacts of water quantity and water quality. What is needed are nature-based solutions that are uniquely suited to the dynamics and conditions found on Michigan's coast. These best management practices would provide coastal communities with the information needed to make informed decisions on what infrastructure solutions would become more resilient to coastal storminess.

Along with technical assistance on implementing nature-based infrastructure solutions, coastal communities also need guidance on how to include nature-based infrastructure solutions into local plans and policies. Approximately 45% of the respondents to the stakeholder engagement survey considered "Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development" should be a focus for the MCMP.

In-Depth Management Characterization:

There is no state agency that consistently tracks, monitors, and calculates the impacts of cumulative and secondary impacts to the coastal boundary, so there is no methodology for determining these impacts nor research, assessment and monitoring. Mapping and databases focus on the impacts themselves, either recording them or reacting to effects of these impacts rather than their cumulative and secondary nature and how other impacts may have resulted in these secondary impacts. As a result, intentional education, outreach, or training are currently not employed by the state.

Management Category	**Employed by State or Territory** (Y or N)	**MCMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Methodologies for determining CSI impacts	No	No	No
CSI research, assessment, monitoring	No	No	No
CSI GIS mapping/database	No	No	No
CSI technical assistance, education, and outreach	No	No	No
Other (please specify)	No	No	No

Table 50: Significant Changes to Management of Cumulative and Secondary Impacts of Development.

Identification of Priorities:

Management Priority 1: Mitigate Inland Flooding due to increased storminess (high lake levels, high-water table, increased impervious surface, increased flashiness due to climate change).

Description: A technical guide of best practices for local governments to implement nature-based solutions that mitigate river flashiness, manage stormwater, and inland flooding and secondary impacts including flooded basements and infrastructure damage, septic system failures, and other critical coastal infrastructure. The guide would include biophysical and social science information that coastal or waterfront communities should consider in order to increase resilience.

Priority Needs	**Need?** (Y or N)	**Brief Explanation of Need/Gap**
Research	Y	Conduct research to determine coastal best management practices, community engagement methods, designs, and design standards reducing flashiness and "storminess" in coastal communities
Mapping/GIS	N	
Data and information management	N	
Training/Capacity building	Y	Training for local governments on the findings of the research and how to incorporate these practices and design standards into their community
Decision-support tools	Y	Tool for local governments to identify how to improve or strengthen local policies to encourage the implementation of nature-based infrastructure solutions for managing stormwater and flooding A tool for local governments to determine their stormwater management goals and what nature-based infrastructure solutions would meet their goals
Communication and outreach	Y	Hands-on workshops that discuss design standards and how to implement on-the-ground best management practices Workshops on community engagement best management practices that include environmental justice considerations
Other (specify)	N	

Table 51: Cumulative and Secondary Impacts Priority Needs

Enhancement Area Strategy Development:

1. Will the MCMP develop one or more strategies for this enhancement area?

Yes ☒
No ☐

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

The MCMP will work to develop technical guidance for Cumulative and Secondary Impacts as identified in a coordinated Adaptation Strategies Toolkit on strategies to inform future education, outreach, and trainings on coastal inland flooding.

V. 2021-2025 MCMP Enhancement Strategies.

A. Implementation of the Coastal Leadership Academy

1. Issue Area(s):

The proposed strategy or implementation activities will support the following high-priority enhancement areas:

- ☐ Aquaculture
- ☐ Energy and Government Facility Siting
- ☒ Coastal Hazards
- ☐ Ocean/Great Lakes Resources
- ☐ Special Area Management Planning
- ☐ Cumulative and Secondary Impacts
- ☐ Wetlands
- ☐ Marine Debris
- ☐ Public Access

Strategy Description:

The proposed strategy will lead to, or implement, the following types of program changes:

- ☐ A change to coastal boundary boundaries;
- ☐ New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;
- ☐ New or revised local coastal programs and implementing ordinances;
- ☐ New or revised coastal land acquisition, management, and restoration programs;
- ☐ New or revised SAMPs or plans for areas of particular concern (APC), including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
- ☒ New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.

Strategy Goal:

The goal is to expand the reach of the Coastal Leadership Academy (CLA) developed from the MCMP 2019 Project of Special Merit to build on the momentum created with this important aspect of education and training of coastal professionals. The ultimate goal is for the MCMP to form a collaborative relationship with the MAP to take a leadership role in co-conducting the CLA in subsequent years thereby expanding its technical assistance and training to coastal decision-makers. The purpose of the CLA is to bring together community leaders and training professionals in a collaborative environment setting to collectively learn and advance the knowledge of resiliency principles, specifically targeting coastal communities. The academy will help underscore the critical hazards facing the community and prepare participants to collaborate and problem solve for more informed local decision-making.

Strategy Short Description:
In collaboration with the MCMP, the MAP will implement the CLA in selected communities/regions. The CLA will build upon work established in the 2016-2020 Hazard Resilience Strategy by using the MCMP Resilient Coastal Communities Planning Guide as its foundation to reinforce resilient planning techniques and best practices into local master plans and zoning codes in the communities where the CLA is delivered.

The target audience for the CLA is local elected leaders, appointed planning and zoning officials, community planners, water resource managers, developers, engineers, real estate professionals, and other key leaders and stakeholders in the community. Teams of 20-35 individuals will be formed in each of the locations. Participating communities will be selected on the basis of interest and readiness, and could be individual municipalities, community clusters, or a region. The intention is to use the time together at the leadership academy to form strong local relationships and engage in shared goal setting that will allow participants to address coastal environmental challenges and problem solve as a team going forward.

Needs and Gaps Addressed:
Over the course of the past several years working on the Hazard Resilience Strategy, the MCMP was informed that coastal communities' resiliency must be addressed by enhanced knowledge, capacity, and commitment. The MAP's Survive and Thrive, Lessons from Michigan Coastal Communities Planning for Resiliency booklet, provided the foundation going forward with targeting knowledge within coastal communities on resiliency principles. The CLA helps to fill the knowledge gap via technical training.

Benefits to Coastal Management:
Implementation of the CLA leverages the established partnerships developed to date, deepens the investments, and expands the reach with coastal communities. A three-module series training module is intended to strengthen local relationships over several meetings; increase the capacity of coastal communities to understand, anticipate, assess, adapt, and/or recover from the coastal processes and hazards of coastal erosion and flooding; provide technical assistance to review and workshop local master plans and codes, and provide a foundation for team members to take action after the academy is completed.

Likelihood of Success:
High success rate with established partner and developed tools. Accomplishing this strategy does not require new statutes, statutory amendments, administrative rule promulgation, or other legislative involvement.

Strategy Work Plan

Total Years: 1 year

Total Budget: $80,000

Year 1 work:
Description of activities

- In collaboration with the MCMP, the MAP will secure commitments to participate from coastal communities.
- Promote and track community participation in the training.
- Confirm venues, dates, food, guest speakers, and other details for coastal communities, and conduct meetings for each community.
- Conduct Coastal Leadership Academies.

Major Milestone(s)

- Conduct CLA in selected coastal communities/regions.

Fiscal and Technical Needs:
Efforts presented within this strategy represent high-priority outcomes for the MCMP, and the need in this area is significant to implement this strategy. Efforts will be entirely funded with Section 309 funds. The MCMP will leverage internal expertise to implement the strategy work plan and guidance document developed under the prior Hazards Strategy. Existing staff will conduct the MCMP's work efforts and maintain the experience and knowledge necessary to guide and assist with strategy components.

B. Resilient Coastal Communities Adaptation Strategies Toolkit

1. Issue Area(s):

The proposed strategy or implementation activities will support the following high-priority enhancement areas:

- ☐ Aquaculture
- ☐ Energy and Government Facility Siting
- ☒ Coastal Hazards
- ☐ Ocean/Great Lakes Resources
- ☐ Special Area Management Planning
- ☒ Cumulative and Secondary Impacts
- ☒ Wetlands
- ☐ Marine Debris
- ☒ Public Access

Strategy Description:

The proposed strategy will lead to, or implement, the following types of program changes:

- ☐ A change to coastal boundary boundaries.
- ☐ New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding.
- ☒ New or revised local coastal programs and implementing ordinances.
- ☐ New or revised coastal land acquisition, management, and restoration programs.
- ☐ New or revised SAMPs or plans for APC including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,
- ☒ New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.

Strategy Goal:

Create the MCMP Resilient Coastal Communities Adaptation Strategies Toolkit (MCMP Toolkit) to provide technical guidance on adaptive approaches for shoreland protection local decision-makers can adopt within their local zoning ordinances. The MCMP Toolkit will include avoidance and managed retreat, accommodation, and shore protection that promotes resilience, restoration, and nature-based solutions that decision-makers can take a balanced approach for the protection of coastal infrastructure and public safety. These adaptation strategies will inform community planning and implementation in accordance with state and federal laws. In addition, the MCMP Toolkit will inform the WRD's resource regulatory programs on on-going and interim process on alternatives to traditional hardened shoreline structures that seeks balance for protecting the coastal resources to that of infrastructure; the MCMP Toolkit guidance will be incorporated as implementation of the WRD Policy, WRD-046.

The MCMP Toolkit will be publicly accessible on the MCMP Resilient Coast webpage with the ability for printable/downloadable factsheets and user guide for ease of use. The MCMP intends to seek project of special merit funding for enhancing the MCMP technical training programs.

Strategy Short Description:
A MCMP Strategy Coordination Team will be formed to explore various toolkit's platforms and scope out the various adaption strategies that will be developed by the respective technical workgroups (e.g., Coastal Erosion, Wetlands, Public Access, and CSI). The development of the MCMP Toolkit will investigate and advance coastal adaptation strategies across the enhancement areas of Coastal Erosion, Wetlands, Public Access, and CSI (inland flooding associated with new and existing development) into a comprehensive digital, public facing MCMP Toolkit. The MCMP Toolkit will provide new information for local and state decision-makers with the objectives of increasing understanding and communication on coastal adaptation approaches including protection, accommodation, retreat, and avoidance.

The first step in building the toolkit is to design the platform of the digital toolkit and template for the individual adaptation strategies. Once the platform is created in the first year, emphasis will focus on scoping out the various adaption strategies specific for respective technical workgroups formed on correlating strategies. In a coordinated manner, the Coastal Erosion, Wetlands, Public Access, and CSI adaptation strategies will feed into the MCMP Toolkit. The MCMP Toolkit will be based on technical guidance for adaptation strategies that include descriptions of the approaches, advantages and disadvantages, and regulatory considerations.

Needs and Gaps Addressed:
Development of a MCMP Toolkit will provide specific guidance to local and state decision-makers, and specifically will help communities make more informed decisions with dealing with challenges related to impacts from development and climate change impacting the coastal boundary. The MCMP Toolkit will address the needs and gaps for all the MCMP by providing guidance on how to protect, accommodate, retreat from, and minimize coastal vulnerabilities to fill significant program gaps for technical knowledge. The current response for addressing coastal erosion and flooding during the high lake levels is the installation of traditional hardened shore structures. This is evidenced in the extreme increased number of shoreland permits issued for installing hardened structures and placing of sandbags. Michigan severely lacks viable options on approaches that minimize impacts and are sustainable long-term solutions. Alternative approaches for nature-based solutions that are long-term and sustainable strategies on the Great Lakes setting are not well known.

Lessons from previous high-water periods have not resulted in improved coastal hazards management or public understanding. As identified in the Phase II assessment, there exists a need to promote retreat and accommodation approaches in addition to efforts to reduce impacts association with traditional options. The MCMP Toolkit will be an impactful tool desperately needed and will be part of MCMP's collective effort to strengthen its relationships with coastal communities by becoming a technical resource as communities seek solutions as part of their adaptive management and decision-making efforts. As stated above, the MCMP Toolkit will provide local and state decision-makers with approaches to be resilient with the changing climate and coastline on continuous basis; meaning, strategies will be developed and published as they are developed.

Examples of tools currently available to help inform the MCMP Toolkit development are the Wisconsin's *Adapting to a Changing Coast publication*

(https://publications.aqua.wisc.edu/product/adapting-to-a-changing-coast-for-property-owners/) and the Cape Cod Commission's *Cape Cod Coastal Planner* (https://www.capecodcommission.org/our-work/cape-cod-coastal-planner/). These tools serve as examples of the type of resources that could be of great value in Michigan; however, the resource needs are that the adaptation strategies must be tailored to the unique Michigan coastal settings and governance approaches.

Given the diversity of the Michigan's coastline along with being the longest freshwater coast, the MCMP Toolkit can also serve as a model for other Great Lakes' Coastal Management Programs.

Benefits to Coastal Management:
This strategy will address multiple adaptation gaps benefitting all aspects of the MCMP by increasing the ability of providing technical assistance to coastal communities, thereby expanding the Michigan's Coastal Hub to local and state decision-makers to enhance the understanding of adaptation options. Coastal erosion and flooding have been identified as two of the most significant hazards within Michigan's coastal boundary. Stakeholder input and past experiences – including those of the on-going Section 309 coastal hazards strategy - indicate a strong need for exploring alternatives to traditional shore protection approaches for long-term planning by local units of government, for their coastal areas. The strategy will examine and convey alternative approaches for local and state decision-makers, to use during the planning process.

This strategy is part of MCMP's strategic direction to strengthen its relationships with coastal communities by becoming a technical resource as communities seek solutions as part of their adaptive management and decision-making efforts. The MCMP Toolkit will be maintained and be accessible on the MCMP Resilient Coast webpage. Hardcopies will also be made available in a downloadable format.

Likelihood of Success:
There is a high likelihood of success. As a networked program the MCMP works closely with our regulatory programs and will have access to technical expertise within WRD. Through our on-going Hazard Strategy, we have built strong relationships and strengthened connections with coastal communities and the local, regional, and state planning entities interested in pursuing alternative approaches towards coastal hazards management. These connections will greatly enhance our ability to seek input and assistance in shaping the MCMP Toolkit as well as support our outreach and education efforts to promote the toolkit and provide technical assistance to coastal communities. The MCMP will continue to leverage this relationship and seek partner expertise and advisement. The MCMP is committed to this effort in order to help coastal communities improve their resilience by having a better understanding of and responses to the changing climate and coastline.

Strategy Work Plan

Total Years: 1-5 years

Total Budget: $2,320,000

Year 1 work:
Description of activities:

- Create the MCMP Strategy Coordination Team (Strategy Team) representing coastal hazards, habitat, public access, coastal waters, and coastal community development.
- The Strategy Team will develop a plan to guide strategy efforts including scope, methods, timelines, format of the toolkit, and rollout/outreach efforts.
- Explore, investigate, and work to create the MCMP Toolkit platform and format for adaptation strategies.
- Create a CSI technical workgroup that will develop the toolkit components.
- Create the Coastal Erosion workgroup that will develop the toolkit components.

Major Milestone(s):

- Strategy Team established.
- Toolkit framework and design scoped.
- Launch the CSI technical workgroup.
- Launch the Coastal Erosion workgroup.

Budget: $400,000

Year 2 work:
Description of activities:

- The Strategy Team will continue to oversee MCMP Toolkit development including individual technical guidance workgroups.
- Continue work on coastal processes, engineering, and mapping needs for coastal adaptation approaches.
- Create the Coastal Wetlands technical workgroup that will develop the toolkit components.
- Continue outreach to rollout MCMP Toolkit adaptation strategies.

Major Milestone(s):

- Toolkit framework and design completed.
- Test system with incorporation of adaptation strategy.
- Incorporate CSI adaptation strategies when completed.
- Incorporate Coastal Erosion strategies when completed.
- Incorporate Wetlands strategies when completed.
- Conduct outreach efforts to local decision-makers and state regulatory staff.

Budget: $480,000

Year 3 work:
Description of activities:

- The Strategy Team will continue to oversee MCMP Toolkit development including individual technical guidance workgroups.
- Continue work on coastal processes, engineering, and mapping needs for coastal adaptation approaches.
- Continue outreach to rollout MCMP Toolkit adaptation strategies.

Major Milestone(s):

- Conduct outreach efforts to local decision-makers and state regulatory staff.
- Incorporate CSI adaptation strategies when completed.
- Incorporate Coastal Erosion strategies when completed.
- Incorporate Wetlands strategies when completed.

Budget: $480,000

Year 4 work:
Description of activities:

- The Strategy Team will continue to oversee MCMP Toolkit development including individual technical guidance workgroups.
- Continue work to understand coastal processes, engineering, and mapping needs for coastal adaptation approaches.
- Launch and finalize work on the Resilient Public Access adaptation strategies and incorporate into the MCMP Toolkit.
- Continue outreach to rollout MCMP Toolkit adaptation strategies.

Major Milestone(s):

- Incorporate Coastal Erosion strategies when completed.
- Incorporate Wetlands strategies when completed.
- Launch of Resilient Public Access technical workgroup.
- Conduct outreach to local decision-makers and state regulatory staff.

Budget: $480,000

Year 5 work:
Description of activities:

- Finalize work on the Coastal Wetlands adaptation strategies and incorporate into the MCMP Toolkit.
- Continue to conduct rollout efforts to coastal communities and state regulatory staff.

Major Milestone(s):

- Completed MCMP Toolkit.
- Completed Outreach efforts.

Budget: $480,000

Fiscal and Technical Needs:
Efforts presented within this strategy represent high-priority outcomes for the MCMP and the need in this area is significant to implement this strategy. Efforts will be entirely funded with Section 309 funds. Multiple areas of expertise are needed to complete the strategy including coastal geology, coastal processes, coastal engineering, GIS mapping, and communications. The majority of these skills, with the exception of the coastal engineering and a portion of the GIS mapping, will be provided in-house through existing staff of the EGLE.

Projects of Special Merit:
Projects of special merit may include enhanced research and policy recommendations for various adaptation strategies such as managed retreat and nature-based shore protections; research to enhance understanding of the economic factors that drive decision-makers towards certain adaptation approaches and the economic effects that would come into play if approaches less impactful to coastal resources are used; and enhanced technical training and outreach on use of the MCMP Toolkit.

2021-2025 MCMP Enhancement Strategies Budget:

Strategy Title	Year 1 Funding 2021	Year 2 Funding 2022	Year 3 Funding 2023	Year 4 Funding 2024	Year 5 Funding 2025	Total Funding
Coastal Leadership Academy	$80,000					
MCMP Resilient Communities Adaptation Strategies Toolkit	$400,000	$480,000	$480,000	$480,000	$480,000	$480,000
Total Funding	$480,000	$480,000	$480,000	$480,000	$480,000	$2,400,000

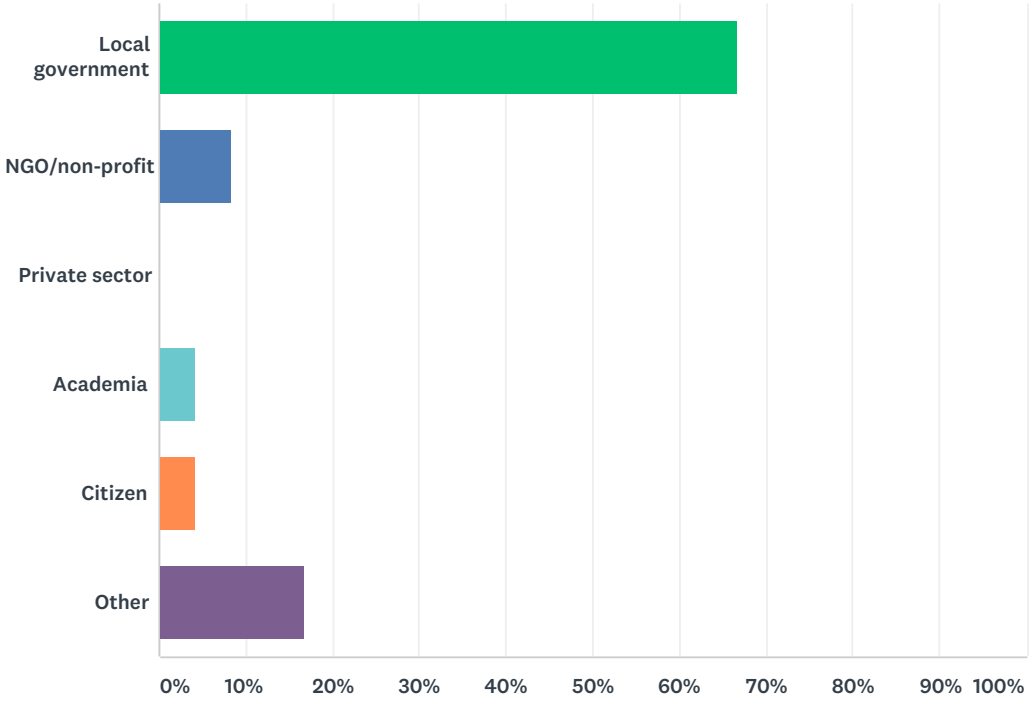
Table 52: Five-Year Budget Summary by Strategy

APPENDIX

A. Stakeholder Engagement Survey

Q1 Identify Affiliation:

Answered: 24 Skipped: 0



ANSWER CHOICES	RESPONSES	
Local government	66.67%	16
NGO/non-profit	8.33%	2
Private sector	0.00%	0
Academia	4.17%	1
Citizen	4.17%	1
Other	16.67%	4
TOTAL		24

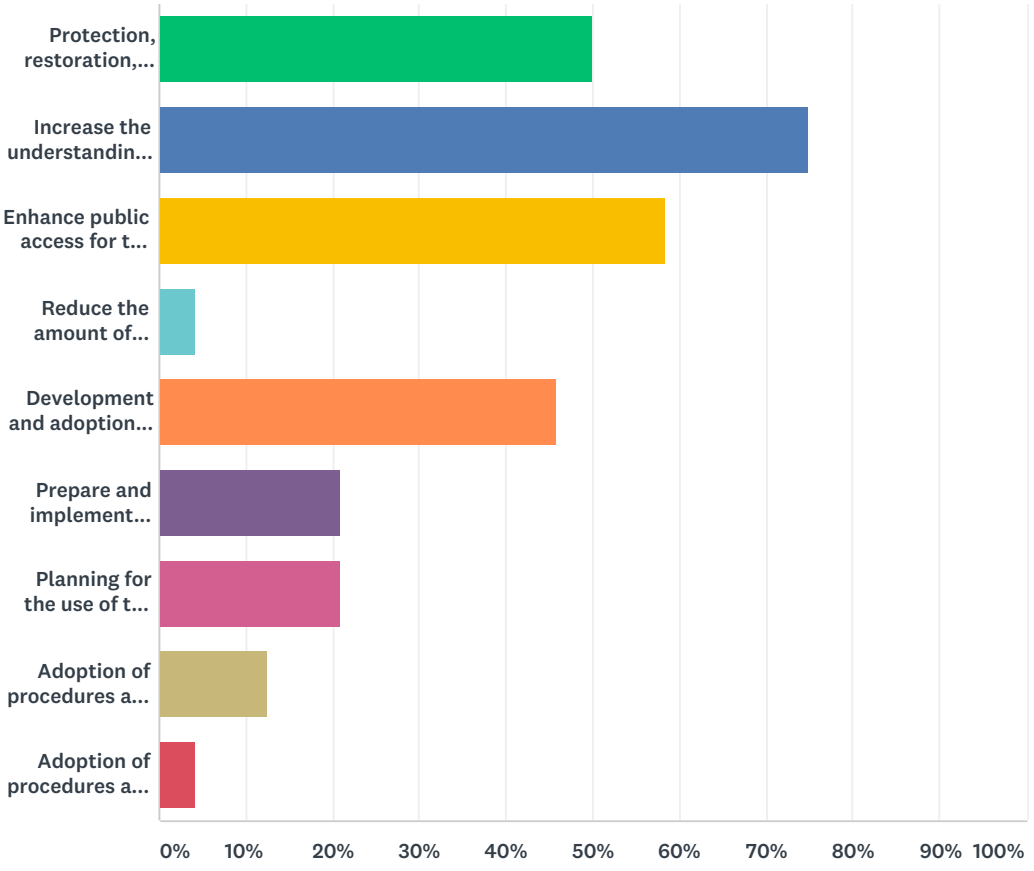
Q2 Describe your current or past working experience, if any, you have had with the MCMP.

Answered: 20 Skipped: 4

#	RESPONSES	DATE
1	If MCMP = Coastal Zone Management (CZM) then--current recipient of grant funding, and was "silent partner" in the Resilient Michigan master plan update.	7/31/2019 11:17 AM
2	We have received grant-funding for projects, and worked with local units of government on joint projects receiving funding from MCMP.	7/29/2019 10:52 AM
3	Grant work - as a grantee.	7/29/2019 8:56 AM
4	As a Regional Planning Organizations we prepare Master Plans and Zoning Ordinances for many of our member coastal communities	7/25/2019 12:20 PM
5	Grant recipient	7/25/2019 11:11 AM
6	No past or current contact	7/25/2019 7:59 AM
7	Just a recent grant application.	7/20/2019 7:40 AM
8	Have not had any.	7/18/2019 5:53 PM
9	Gulliver Historical Society	7/18/2019 7:21 AM
10	none	7/18/2019 5:39 AM
11	none	7/18/2019 4:35 AM
12	We constructed a handicap kayak launch at a park on an inland lake.	7/17/2019 7:45 AM
13	None	7/17/2019 6:30 AM
14	Attended Coastal Resiliency presentation	7/17/2019 6:26 AM
15	I don't believe we have worked with MCMP.	7/17/2019 4:33 AM
16	Not directly but worked with OGL on many initiatives	7/16/2019 5:01 PM
17	none	7/16/2019 3:41 PM
18	Regional Planning Organization with past grants for planning blueways, greenways, green infrastructure, water trails, coastal resiliency plans.	7/16/2019 12:56 PM
19	I have secured a number of grants over the years to survey different coastal systems and conduct public outreach	7/16/2019 11:45 AM
20	Years I ago I worked on a CZM grant	7/16/2019 10:06 AM

Q3 Based on the MCMP mission statement, identify the top 3 areas that the MCMP should focus mostly on:

Answered: 24 Skipped: 0



ANSWER CHOICES	RESPONSES	
Protection, restoration, preservation of coastal wetlands.	50.00%	12
Increase the understanding of risk and mitigation associated with coastal hazards, (e.g. erosion, flooding, coastal storms).	75.00%	18
Enhance public access for the use and enjoyment on Michigan's coastline.	58.33%	14
Reduce the amount of marine debris entering the Great Lakes by managing use and activities.	4.17%	1
Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development.	45.83%	11
Prepare and implement special area management plans for important coastal areas.	20.83%	5
Planning for the use of the Great Lakes resources.	20.83%	5
Adoption of procedures and enforceable policies to help facilitate the siting of energy and government facilities within the coastal zone which may be of great local significance.	12.50%	3
Adoption of procedures and policies to evaluate and facilitate the siting of public and private aquaculture facilities in the coastal zone.	4.17%	1
Total Respondents: 24		

Q4 Based on the top 3 areas you selected, what are the biggest challenges for each area?

Answered: 22 Skipped: 2

#	RESPONSES	DATE
1	protection of wetlands, responsible resiliency re developmentnt	8/8/2019 7:47 AM
2	To begin, the selection options are odd. They're either very broad or quite specific. Challenge 1 - are you CZM that is n/k/a MCMP? If you're going to "lean-in" with us, we'd like to know who you are :) Biggest challenge for coastal wetlands is identifying them, delineating, and then regulating because most of them are on private property. And the government asking to delineate the wetland will probably not be well received by a property owner. Coastal hazards - erosion is the largest problem my community is facing; teaching wealthy land owners on Lake Michigan to mitigate first, so there aren't issues is very hard. It's also hard to tell them they're not allowed to put in a seawall and must develop a plan without hard structures. I picked cumulative and secondary impacts because it was one of the broader topics, and one I don't think is well researched. I think the results would be interesting, but also difficult to quantify because there could be numerous other factors leading to cumulative and secondary impacts. Lastly, another challenge is letting Michiganders know the scope of the MCMP...you're restoring wetlands, building energy facilities, and siting aquaculture facilities? "One of these things is not like the other..." comes to mind.	7/31/2019 11:17 AM
3	Balancing environmental concerns with economic growth.	7/30/2019 6:10 AM
4	For coastal wetlands, the biggest challenge is funding. MCMP funding amounts are generally too small to leverage large-scale projects, and can't be used in conjunction with other federal funding, and CELCP takes too long and is not eligible to go to NGOs. In an area with small, unsophisticated government entities, this is a major problem. For enhancing public access, funding is also the primary impediment, at least for larger scale or universally-accessible infrastructure. For Special Area management, I suspect the biggest impediment is going to be opposition to government-imposed property designations and perceptions (real or otherwise) of loss of property rights.	7/29/2019 10:52 AM
5	Communication with new owners unfamiliar with coastal hazards.	7/29/2019 8:56 AM
6	Reducing the amount of marine debris entering the Great Lakes	7/25/2019 12:20 PM
7	Funding, balancing the support for use of natural assets with overuse and oversaturation of visitors to sensitive areas	7/25/2019 11:11 AM
8	All three cited interact to protect the integrity land water interface	7/25/2019 7:59 AM
9	The political power and influence energy facilities have.	7/20/2019 7:40 AM
10	the residents and finding locations for public access.	7/18/2019 5:53 PM
11	Gulliver Historical Society maintaining Seul Choix Point and Historical information	7/18/2019 7:21 AM
12	budget, public awarness/attitude	7/18/2019 5:39 AM
13	costal hazzards due to high water	7/18/2019 4:35 AM
14	Funding	7/17/2019 7:45 AM
15	Public Cooperation, funding, local control issues	7/17/2019 6:30 AM
16	Gold coast homes built on unstable dune areas, diminishing access for the public.	7/17/2019 6:26 AM
17	Mitigating erosion.	7/17/2019 4:33 AM
18	Public awareness of the issues; knowledge about prioritizing coastal wetlands conservation and identifying specific solutions to existing flooding problems on public and private property	7/16/2019 5:01 PM
19	My biggest concern is the lack of knowledge about Lake Superior coastline the recent high waters and in the past the lower levels. People and developers like to place buildings as close as they can to the water. My view is they should be back at least 400 ft from the highest recorded level- otherwise don't build	7/16/2019 3:41 PM

20	Implementation of public policy that supports wetland protection rather than filling/drainin; Investing in the prevention of hazards rather than repairing damage after the fact; Sustaining and maintaining public access and public ownership of coastlines when faced with private development pressure.	7/16/2019 12:56 PM
21	The # 1 issue for all three is lack of high quality, accurate data and information. Specifically for Coastal Wetlands = under assault from a number of threats - impacts from changing water levels needs to be better understood; cumulative and secondary impacts = lack of research on how different development types and patterns impact different types of coastal ecosystems; Special area management plans = determining locations and boundaries of priorty areas, and engaging a diverse group of stakeholders in the development and implementation of the plans.	7/16/2019 11:45 AM
22	Convincing people to value the natural resources and to think of them as finite.	7/16/2019 10:06 AM

Q5 Based on the top 3 areas you selected, what are the opportunities for the MCMP to more effectively address the challenges?

Answered: 22 Skipped: 2

#	RESPONSES	DATE
1	Provide resources to locals and regions to advocate	8/8/2019 7:47 AM
2	Coastal hazard erosion--would be very nice if MCMP hosted neighborhood workshops or something to inform the shoreline proprety owners what options they have for addressing the erosion. Most of them only know of a seawall, and there are many other options. Or even relaying that info to the local government, so we have the info to distribute when they call and ask what they can do. Coastal wetlands--minimally the delineations will have to be publically funded. You'll never get total cooperation. You'll also have to guarantee there will be little to no impact on that property owners taxes or ability to use their land. Impacts--common sense tells us what many of the impacts may be, but perhaps an FAQ or infograph or something could be provided to local units through a weekly digest email on these impacts, so we're aware of them. In addition, please treat us like people. We're on the ground every day with residents working face to face. There is a level of automony when you start getting to the county and state level, and there is a lack of understanding or a lack of appreciation for the extra stress that comes with working at the local level and having residents and elected officials with full access to you. Ask what we know, what we struggle with, where we need help...explain how you can be our partner and support the work we're doing, so we can in turn support the work you're doing. It's so much better if we all work as a team.	7/31/2019 11:17 AM
3	Provide as much information as possible to help us with decision making.	7/30/2019 6:10 AM
4	1. Work with the federal government to streamline, speed-up and allow NGO eligibility for CELCP funding. 2. 3. Education and outreach to coastal communities and NGO conservation organizations.	7/29/2019 10:52 AM
5	Increased communication through realtors, local government, citizens.	7/29/2019 8:56 AM
6	Support planning initiatives for the local units of government the manage the land use along the coasts	7/25/2019 12:20 PM
7	Coastal Zone Management grants for planning projects and technical studies, improvement of public access areas	7/25/2019 11:11 AM
8	I don't have any idea	7/25/2019 7:59 AM
9	Get involved with FERC or other agencies to enforce some sort of compensation for ecological impact.	7/20/2019 7:40 AM
10	not sure.	7/18/2019 5:53 PM
11	Grant funding	7/18/2019 7:21 AM
12	public outreach, more awareness of MCMP	7/18/2019 5:39 AM
13	no idea	7/18/2019 4:35 AM
14	Identify additional funding.	7/17/2019 7:45 AM
15	Include impacted local governmental agencies up front	7/17/2019 6:30 AM
16	Present directly to coastal planning commissions. Public education on beach use law.	7/17/2019 6:26 AM
17	They need to have discussions with the local government	7/17/2019 4:33 AM
18	Develop key messages for the public; map coastal wetlands, functions, values and priority conservation opportunities; secure funding to solve existing coastal flooding problems	7/16/2019 5:01 PM
19	Assist us with zoning and enforcement	7/16/2019 3:41 PM

20	Deliver information and continuously educate local decision-makers (elected officials and municipal staff) about their role in upholding public trust of public resources and their ability to use planning policies to require private development to protect natural resources and public access.	7/16/2019 12:56 PM
21	Continue to support applied research to better understand key processes of coastal ecosystems and how different human activities impact these systems and associated species. Work with regional planning agencies across the state. Collaborate with coastal experts to identify and delineate important coastal areas.	7/16/2019 11:45 AM
22	The high lake levels are bringing people's attention to the water - capitalize on that!	7/16/2019 10:06 AM

Q6 Based on the top 3 areas you selected, in what manner (e.g. technical trainings, outreach, research, other) do you see the MCMP best addressing the issues?

Answered: 21 Skipped: 3

#	RESPONSES	DATE
1	Outreach and train the trainers....partner with regions.	8/8/2019 7:47 AM
2	Clarification is needed--technical assistance or technical trainings. Those are two very different things. Tech assistance is useful, but not tech training. Too much change over at the local level and/or we're not an expert in the technical subject. If I need technical assistance it's likely for a subject that rarely comes up, and only need a little help.	7/31/2019 11:17 AM
3	Training and information.	7/30/2019 6:10 AM
4	In all honesty, we've never engaged with MCMP in any way other than through grants. MCMP has not historically been at the table, or considered a stakeholder in regard to local coastal issues in our region.	7/29/2019 10:52 AM
5	Outreach and research.	7/29/2019 8:56 AM
6	Providing technical assistance to local units of government that are often lack the resources to develop actionable plan to properly manage their coastal environments	7/25/2019 12:20 PM
7	Coastal Management grants on a 3-year basis, with potential renewals if targets and benchmarks are achieved, research through the existing network of universities in the State	7/25/2019 11:11 AM
8	Research, model law/ ordinance, education	7/25/2019 7:59 AM
9	Providing research.	7/20/2019 7:40 AM
10	outreach	7/18/2019 5:53 PM
11	Training, outreach	7/18/2019 7:21 AM
12	reaching out to communities to educate	7/18/2019 5:39 AM
13	political to get funds for management	7/18/2019 4:35 AM
14	Outreach, technical training and genreral marketing of programs and services available are the best ways to address the areas.	7/17/2019 7:45 AM
15	Outreach	7/17/2019 6:30 AM
16	Research on effects and effectiveness of armoring (retaining walls, etc), forecasts of future lake levels to determine prudent setbacks. Facilitating funding for buybacks on homes that never should have been built.	7/17/2019 6:26 AM
17	outreach	7/17/2019 4:33 AM
18	Secure funding; technical training; develop partnerships	7/16/2019 5:01 PM
19	technical trainings	7/16/2019 12:56 PM
20	Really hard question because they are all equally important and all necessary. If MCMP isn't doing all of these things - who will? At the core of all of this is targeted appllied research. Once that is at a good place, the knowledge needs to be shared with those potentially impacted. In the end, I always come back to research and outreach. .	7/16/2019 11:45 AM
21	I've seen firsthand how the technical trainings and outreach are impacting local govt. Keep that program support going.	7/16/2019 10:06 AM

Q7 Based on the top 3 MCMP focus areas you selected, what are the biggest challenges facing coastal communities' ability to be resilient?

Answered: 22 Skipped: 2

#	RESPONSES	DATE
1	land use planning and zoning challenges; incentives	8/8/2019 7:47 AM
2	See answer 4, this is the same question just reworded a bit. I don't see enough of a difference in what you're asking to provide a response different than #4.	7/31/2019 11:17 AM
3	Finding grant funds to help with mitigation and to respond to emergencies.	7/30/2019 6:10 AM
4	1. Most of the coastal communities in our service area lack the financial and technical resources to think about resiliency.	7/29/2019 10:52 AM
5	Lack of understanding of one's impact on another.	7/29/2019 8:56 AM
6	Having a plan in place that provided the guidance they need	7/25/2019 12:20 PM
7	Lack of foresight and professional staff to be able to adequately identify vulnerabilities and how the community would react and respond	7/25/2019 11:11 AM
8	Managing growth and impact of climate change	7/25/2019 7:59 AM
9	Lack of knowledge of how to respond and plan or prepare.	7/20/2019 7:40 AM
10	Oversight by the state.	7/18/2019 5:53 PM
11	working with all volunteers, getting young volunteers.	7/18/2019 7:21 AM
12	funding, lack of volunteerism	7/18/2019 5:39 AM
13	being an island, access to mainland on a reliable ferry and free of ice congestion in winter	7/18/2019 4:35 AM
14	This year, high water is a challenge. Lake Michigan residents and Mona Lake residents are experiencing erosion issues.	7/17/2019 7:45 AM
15	I don't know	7/17/2019 6:30 AM
16	Educating the public as to the true nature of lake Michigan. She is not a swimming pool. She eats coastlines and claims souls.	7/17/2019 6:26 AM
17	Regulations	7/17/2019 4:33 AM
18	No clear direction on the issues; lack of understanding at local level; lack of resources to update planning documents to work to the future	7/16/2019 5:01 PM
19	Resistence from developers and the public building stuff that will be wrecked by the winter storms within a few years.	7/16/2019 3:41 PM
20	The expense of repairs associated with damaged storm drain infrastructure and the lack of knowledge about the benefits of green infrastructure and how it can be designed to be maintained in a way that may be different than business as usual, but with cost effectiveness and greater social, environmental and economic benefits for communities.	7/16/2019 12:56 PM
21	Biggest challenge in most cases is scientifically sound, up-to-date and accurate information about both the ecological systems and human activities/systems. This area of study requires an approach that sees the coastal landscape as a coupled socio-ecological system that requires an intensive cross disciplinary approach, strong community participation, and long-term on the ground partnerships.	7/16/2019 11:45 AM
22	Acknowledgement that the climate/situations have changed and that we have to do things differently.	7/16/2019 10:06 AM

Q8 Where do you see the MCMP role, or how could the program change or enhance itself, to better support efforts to build coastal resiliency, adapt to climate change, or address other coastal issues facing communities?

Answered: 19 Skipped: 5

#	RESPONSES	DATE
1	partnering with the regions.	8/8/2019 7:47 AM
2	See answer 5, this is the same question just reworded a bit. I don't see enough of a difference in what you're asking to provide a response different than #5.	7/31/2019 11:17 AM
3	Coordination between the various communities and governmental entiies along the lakeshore,	7/30/2019 6:10 AM
4	Engagement in the development of watershed management plans and coastal county master plans, development of model zoning language for coastal communities. It would be great to get Federal and State agencies to acknowledge climate science and the threats of climate change as a first step toward community adaptations.	7/29/2019 10:52 AM
5	Continue to research and distribute information.	7/29/2019 8:56 AM
6	education and funding	7/25/2019 12:20 PM
7	Ongoing funding support, training on best practices and/or training that addresses resiliency	7/25/2019 11:11 AM
8	don't know	7/25/2019 7:59 AM
9	Not sure, I am new to MCMP	7/20/2019 7:40 AM
10	climate change programs and clean enviroments issues	7/18/2019 7:21 AM
11	public education	7/18/2019 5:39 AM
12	do not believe in climate change	7/18/2019 4:35 AM
13	With cuurent high water, technical assistance with erosion control would be a big help.	7/17/2019 7:45 AM
14	I don't know	7/17/2019 6:30 AM
15	Secure funding to solve on the ground flooding issues; develop template planning documents for local communities; work with regional MPOs on training, local planning and long term transportation planning	7/16/2019 5:01 PM
16	Public information meetings -- we have about 5 miles of undeveloped coastline on Lake Superior	7/16/2019 3:41 PM
17	MCMP has been doing a good job with very limited funds, especially by supporting planning efforts. A better program would include more funding for local communities to implement/construct projects for coastal resiliency	7/16/2019 12:56 PM
18	See # 9 below	7/16/2019 11:45 AM
19	Showing examples of before/after works. The maps showing the three levels of storm impact on a community have great impact too.	7/16/2019 10:06 AM

Q9 Additional Insights: Please provide any additional comments for the MCMP to consider.

Answered: 13 Skipped: 11

#	RESPONSES	DATE
1	I work at a region. We can and do facilitate workshops/summits, etc and are willing to partner with you and your resources.	8/8/2019 7:47 AM
2	I don't know about the MCMP and that may be an issue to consider.	7/25/2019 7:59 AM
3	I look forward to learning more about MCMP and it’s efforts.	7/20/2019 7:40 AM
4	Just another state funded oversight group to tell local property owners what they can and cannot do.	7/18/2019 5:53 PM
5	Thank you much for grants that we have received.	7/18/2019 7:21 AM
6	I am more familiar with Army Corps of Engineers and EGLE than this division, not sure what resources MCMP has available.	7/18/2019 5:39 AM
7	Water levels fluxuate on a cycle...we are in the highest ever right now, and it will go down again.	7/18/2019 4:35 AM
8	I don't know what all the challenges a coastal community has to face; I'm sure they could provide much better responses than I can.	7/17/2019 6:30 AM
9	I also work with the Great Lakes Water Safety Consortium. We fervently wish that a fraction of the Pure Michigan money spent attracting people to our shorelines was spent on educating visitors as to the dangers of the big lakes. We should be also educating people who buy on our shorelines, much the way we warn those who relocate to farm country about the sounds and smells of agriculture.	7/17/2019 6:26 AM
10	In the area of climate change or whatever you want to call it, public funds should not be used to rebuild recreation areas and roads that are subject to repeatingly getting flooded and destroyed.	7/16/2019 3:41 PM
11	Have a good day.	7/16/2019 12:56 PM
12	Ecological Systems (dunes, great lakes marshes, coastal fens) and ecologically defined places (Les Cheneau Islands, St. Clair Detroit River system, southern Lake Michigan basin, etc) are two approaches (or frameworks) that MCMP should utilize (or continue utilizing) to best advance its goals.	7/16/2019 11:45 AM
13	If you had the resources - show each coastal community what happens when storms hit and what happens if they take measures to combat the impact.	7/16/2019 10:06 AM